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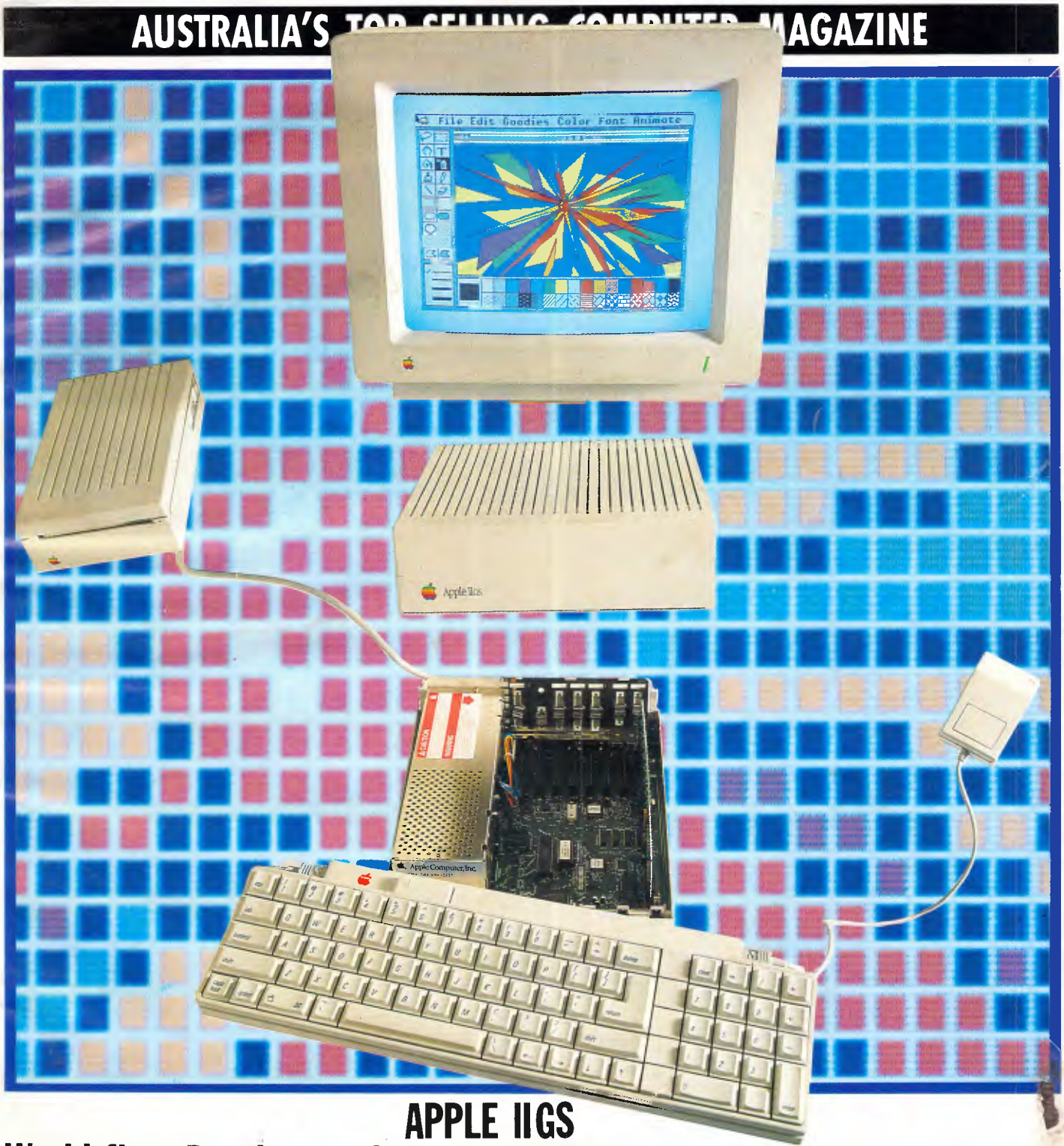

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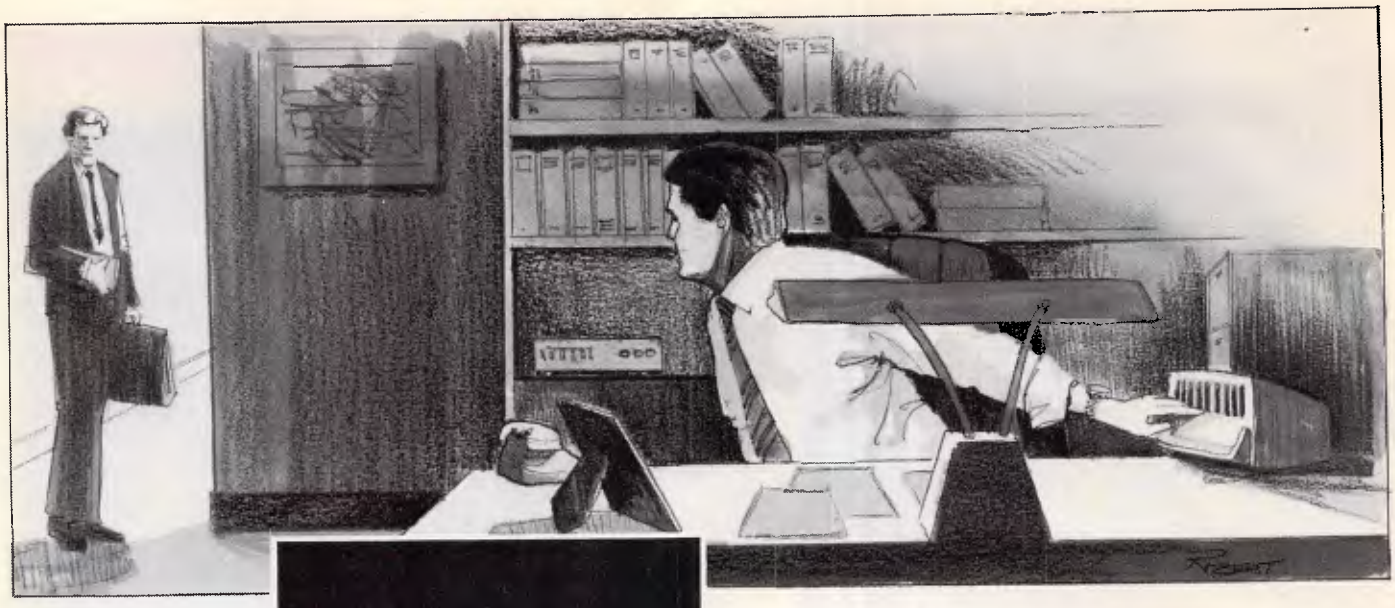
FEATURES

SPECIAL FEATURE

Next month, APC*'s Networking Special continues with a look at IBM's Token Ring and whether it will become an industry standard; as well as a list of some of the LAN's that are currently available.*

BENCHTESTS & REVIEWS



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DMP 18

Amstrad's new PC, crippled software and Irish 'backsolving' programs are all mentioned in this month's world-wide micro news round-up.

All sorts of pop-ups

The Deskset solves a disk organisation problem which I hope you have never experienced.

All my readers — I am sure — are thoroughly organised administrative whizzes, without one scatty, untidy or absent-minded individual among you. That being so, not one of you has ever been doing something with a PC and suddenly been confronted with an unlabelled diskette, and an urgent need to create a file on it, or read one off it.

There are some programs which regard this as an acceptable problem. While running these programs, you can examine the disk, somehow, and find out:
a) what it actually is; and
b) how much space is left;
or even c) whether the file you really want is on it already.

But I've lost count of the number of programs which won't allow this. They expect you to work with a little notebook of all the directories and filenames you have ever created.

With a particular part of the Deskset, you can, at any time, press ALT and U (for Utilities) and you can read the directory, change directories, rename files, log-in new disks,and generally do emergency housekeeping.

This handy little program takes up around 29k of memory — which is to say, virtually nothing — and I'll keep it, after I review and return the rest of the Deskset.

The rest of the package is, by comparison, fairly unessential RAM-resident software. Some of it is pretty good, but the real beauty of it is that you don't have to use it.

There's a little word processor. It obeys basic WordStar directions, and theoretically offers a maximum document size of 18k (experiment shows it actually restricts you to 9000 bytes). There's an alarm clock which takes 16k; a calculator which takes 10k; a complex financial calculator which takes around 35k; a date-stamper which takes around 25k; a program for dialling phone numbers which uses 20k or so; and a quite extraordinary option called Pop-up Anything which lets you run other programs, as long as they take less than 192k.

All these (bar Pop-up Anything) are functions which, by and large, you can get on existing RAM-resident programs.

Sidekick, for example, will happily edit text and dial numbers, and also has a nifty calculator and appointment scheduler. Spotlight has the DOS utility, but Spotlight takes up a lot of memory, and you have to use all its other pieces as well.

Personally, I have no need for a pop-up word processor; I use the pop-up outliner, PC Outline. Someone with Sidekick would probably feel the same. But we both need a pop-up DOS utility. Other combinations of features and missing features could be postulated.

Amstrad's PC-compatible is, it would seem, likely to further exacerbate our trade deficit when it's released next month. Last month we predicted a rrp of less than $2000; it's certainly going to be that, and less. AWA has suggested as this issue went to press that the Amstrad will sell from $1499 for a single drive system with monochrome monitor. That same machine sells for £399 in the UK — exactly what the Amstrad PCW8256 sold for when it was released last year. The PCW8256 now sells for $1399 here. However the important point is that the PC will come under far greater pricing pressure than the 8256 ever did: the 8256 has very little competition — you just can't buy any other complete word processing system including printer for this sort of money. So the Amstrad PC's price is almost certain to fall from its already low level. And the British will still make money out of us. How? Why? The average British salaries are now higher than those in Australia (don't be confused by hearsay. It's a fact: Australians, due to the dollar's decline, are now paid less than the British, Americans and Japanese workers). Our country's population is smaller, yes, but reduced efficiencies of scale in the cost of Australian manufacture due to this would not exceed the savings made because of lower wages. So why isn't there an 'Amstrad' in Australia, pumping out ultra-cheap, well built and reliable PCs for the masses? If the British can manufacture a machine with higher wages, ship it half-way around the world and sell it for $1450 (or less), so Australia should be able to produce its own PC for considerably less.

A full Benchtest of the Amstrad PC will appear in the next issue.

With Deskset you can fill in the missing blank, because each pop-up program is available on its own, with or without its fellows.

As it's the pop-up DOS that attracts me most, I tested it most thoroughly, and found it to be a noticeable improvement on standard DOS commands.

For example, in addition to the DIR command, there's XDIR, which shows the first few ASCII codes in the file.

Then there's the ability to PRINT, as if with the DOS utility but with additional features allowing you to set printer attributes such as bold, emphasised, condensed, and so on.

Changing directories is a feature with an extra. You can change permanently, possibly causing confusion to your main applications. But you also have the option to change temporarily, just in order to perform some local function, with the knowledge that when you drop back out of pop-up DOS, the original directory will be recalled for your application. The system actually warns you, when you return, that you've changed directories, and asks if you wish to return.

Unfortunately, you can't format disks. You need Pop-up Anything to do that, and that's one of several unguaranteeable features of the entire Deskset.

Most of them aren't crucial. Hopefully, the manufacturer will be able to fix (or explain) the dialler, which dials the number OK, but won't let you talk to it. And hopefully, one day, the company will come up with a version that lets us use non-Hayes modem commands. Or with a modem that doesn't have Hayes DIP switches. What's the use of the instruction to set 'switch one up', and switch 6 down' on a modem without switches? The only Hayes modem I know that actually has the switches is Hayes' own brand, and that isn't a market leader in Australia, is it?

For some reason, there's no such program as Pop-modem, despite its appearance in my preliminary copy of the documentation.

But in general, I'm happy with these programs, with their nice features — the ability to invoke the programs with different keys, for example, if they perform other functions in your favourite software. Or the choice of foreground and background colours.

Just wait until an Australian version is advertised, that's all.

Guy Kewney

Forth tongues

Of consuming interest to those who try to advance the state of the programming art to new frontiers, will be the November conference in California, called the Forth Modification laboratory, FORML.

The conference is a 'forum for sharing and discussing new proposals to enhance the Forth computer language.'

That sounds great, but you have to be warned that one of the organisers is the Forth Interest Group, or FIG. This notoriously conservative body has resisted any changes and improvements beyond the obvious, so far, to the point where Chuck Moore, inventor of the language, can barely bring himself to speak politely about the group.

This year, FIG is trying to 'extend Forth towards the 1987 standard.'

The venue is the Asilomar conference grounds in Pacific Grove, south of Santa Cruz, and the dates are November 28-30.

Registration details from FIG at PO Box 8231, San Jose, California 95155.

Mirror image

There are only two things I don't like about a communications program, called Mirror, which runs on the PC. One is that it won't do viewdata communications,

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and the other is that it has an unfortunate clash with Sidekick.

In every other respect, I can now use Mirror instead of my previous comms package, Crosstalk XVI version 5.3, and do things that Crosstalk just can't do.

The main things that I like about Mirror are concurrency and memory residence.

The program is now permanently loaded on my M24, and not only 'pops up' into view every time I press both shift keys, but carries on running in the background, sending and receiving information, while I get on with my *creating* job. Writing, that is.

It is possible, for example, to program Mirror with a 'script file' to wake up every five minutes — whatever else may be happening — and check a certain disk. If it finds a file called 'REVIEW. PRN' it will then dial Minerva, log-on and send mail to a particular mailbox (*APC*'s editorial mailbox). It will then log off.

All I have to do, is to tell my text program (PC Outline) to create a file called REVIEW. PRN from the text I've written so far, and my news column disappears down the line without my having to think about it. In instalments. I can keep typing.

Even if it didn't do this, I'd still use it, instead of Crosstalk, for the simple reason that Crosstalk can't stay memory-resident. And if Crosstalk could do that, I'd still prefer Mirror, because Mirror knows about MS-DOS directories.

Ask Crosstalk to transmit a file in C:/TEXT directory, and it will not find it, because Crosstalk isn't in that directory. Mirror will.

So I'm a bit annoyed to discover that the authors of Crosstalk are sueing the authors of Mirror, for breach of copyright. Their grounds: the Mirror log-on screen looks very similar, and it obeys the same commands.

Frankly, I'm sceptical about the chances of the suit succeeding. Precedent in America, says the Mirror authors, is heavily on their side. I have to agree. And Mirror goes so much further than Crosstalk that you couldn't call it a copy. I don't know of an Australian distributor yet — but then I don't see this issue's advertisements until *APC* is published. So it's up to you to scour.

Guy Kewney

Dealer failures

There's supposed to be a mystery about the number of large chains of computer dealers all over the world, all of whom are going bust.

There is no mystery, as anyone who has a car could easily tell you.

If, on buying a car from a large distributor, you took the car back and complained of a knocking noise in the engine, you would expect to meet a mechanic.

On buying a computer from a large distributor, if you enter the shop and complain of a clunking noise from the disk, you will meet a sales executive.

With the car mechanic, it will quickly become apparent that mechanics know more about the events under a car bonnet than drivers.

With the computer sales executive, it will equally quickly become clear that you, having read no more than the manual, are an experienced, expert and well-informed person, by comparison with the under-qualified salesman standing in the smart shop.

You can recognise these stores very easily. Go in, and ask them who does their maintenance. They will say: 'Dictaphone' or 'Mister Fixit', or some other impressive firm of earpiece sanitisers. Leave the store immediately, and buy your computer from DictaFix, or whoever.

This simple logic has been followed by enough buyers

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of personal computers to provide ample explanation of why so many smartly-decorated stores are closing down. The only mystery is why the proprietors of these useless, parasitic consumers of shoplifting artefacts are in the least mystified by their problems.

Guy Kewney

Simple maths

Assuming that you had been given a formula to work out how many turns you need for a transformer coil, or the angle needed for the main strut of a hang glider, or even something 'simple' like ('Y = sin [2*X + 4]) + X', how would you use a computer to solve it?

The answer, according to the Irish firm, Flite Software, is you buy Equals 22, an equation processor.

It is touted as doing simultaneous linear equations, as being able to backsolve, and as being able to do curve-fitting problems, transferring its data into WordStar and Lotus 1-2-3.

All you need, then, is the address in Letterkenny, Co Donegal, Ireland, which is Pearse Road; the phone number, which is 353 74 23023; and the price, which is $465, and you should be satisfied.

And if you don't think that's particularly clever, you have obviously never tried solving mathematical equations with a computer.

386 potential

Faster than the 80286, the new Intel 80386 chip now being installed in Compaq's newest micro should be capable of changing the face of desktop computing.

Following the Compaq launch (at press time, I didn't have full details) we can look forward to seeing similar machines from Corvus, and other people who up till now have followed the Motorola family of chips, but who now think they need to join the Intel bandwagon.

The question of just how much it will actually change things, is not easy to answer.

At first, all the new chip will do is run four times as fast as the 80286, but doing exactly the same programs. That's about 20 times the speed of the original IBM PC.

But when IBM produces a machine based on the 80386, say the wise men, then it will have a new Microsoft-written operating system, capable of running DOS programs and Unix programs together, capable of taking micros into the realm of minicomputers, and capable of making new types of programs.

It's easy to say. Technically, it's all possible. The 80386 has the ability to address 32 bits' worth of memory — that's four gigabytes, over four thousand million words of data and program. It has the ability to keep two programs running on the same machine, and the ability to keep them from interfering with each other, which the 80286 can only do if correctly programmed. And it has the speed.

Initially, however, the only operating system that takes advantage of all this potential is Unix, version 5.3.

This isn't the moment to provoke a shouting match between programming hooligans from the pro and anti-Unix ends of the world. If Unix is really the only way we can find to cope with multi-tasking on a single-user machine, then Unix will be used for multi-tasking on the new generation. If IBM's is the only alternative, then it will also be used.

But the next real advance in computing power is

waiting for a different approach to computing, not just a bigger operating system on a faster chip.

Looking at things like Alan Kay's attempts to create 'software agents' inside applications, like attempts to generate computing ideas that process themselves rather than waiting for a central machine to grind through, you can get a good idea of what the potential really is.

And more clearly than that, you can see that the potential is not for 1987, nor for 1990, but for 1995.

In the meantime, computing might occasionally look a little dull. If it depresses you, try thinking of what's going on today as though it were a cocoon.

Inside, apparently dead, is the chrysalis of new ideas, changing from crawling caterpillar to colourful butterfly.

And just hope that some Archeopteryx doesn't happen to come along and swallow it before it hatches.

Guy Kewney

Watch out! — shady software about

A lot of software producers are panicking about ultra-cheap PC-compatibles like the forthcoming Amstrad PC, because they think people might be reluctant to spend $1500 on a software package to run on a $1300 machine.

This says a lot for their intelligence, especially when they recognise the market's requirement for $200 packages. But they wish to continue to make $1400 profit rather than the $100 profit they'd make on a $200 package. Tricky.

Inspiration, they say: let's produce a version that runs only on, say, the Amstrad, and which doesn't do quite so much. No-one will be able to use it on ordinary, full price PCs, and we'll keep our high margin stuff.

Watch out for products like the Delta database with only 1000 records, or — well, we're compiling a list. Let us know what you find in this crippled software line, will you?

Poor maintenance

When Lotus announced its Version 2 of Lotus 1-2-3, it turned out not to do some things the way the original spreadsheet did.

The company has now released version 2.01, which doesn't insist that you follow Symphony conventions, and works with ordinary 1-2-3 data files.

This is called a 'maintenance release' of the program, and details are available through knowledgeable dealers.

Off it comes

As if struck by inspiration from above, Ashton-Tate has removed copy protection from all of its MS-DOS-based software. Its managing director said, "the company felt it was important to eliminate copy protection to provide users with a more productive and convenient way of using, installing and backing-up program files". So previously, evidently, the company either didn't think it 'important' or hadn't thought of not copy protecting software.

The lack of protection and arguably increased risks of

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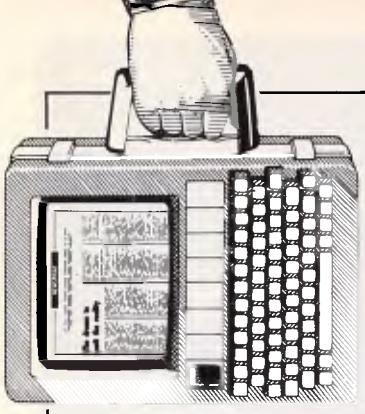


software piracy no doubt arouse feelings within Ashton-Tate similar to participating in a first nudist beach 'experience' — total vulnerability — so it's good to see the company's announcement continuing to announce the removal of copy protection on its Mac software too.

Getting it all wrong

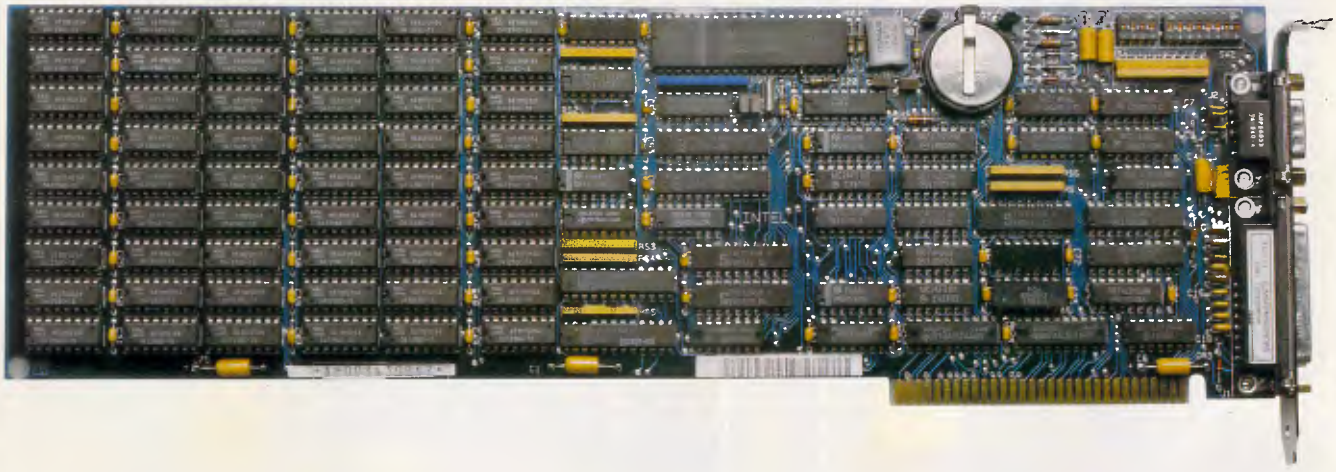
If you were the MD of a company which had just announced a profit of around $1.9 million for the June quarter you'd brag about it, right?

Wrong — if you're Commodore's MD, that is. Instead Commodore pumped out a statement which begins: "Commodore Computers in the United States has announced a $125 million dollar profit *improvement (our italics — Ed)* for the June quarter compared with the June 1985 quarter."

Which means Commodore lost around $123 million a year ago. That's the sort of loss a company should forget about, as best it can, not remind people of it.

And if that weren't enough, Commodore, don't drop another clanger, in the same month! When competitors spread rumours about a product's demise and the media bites, the standard, sensible and advisable course of action is to do and say absolutely nothing. Don't draw it to anyone's attention. And, above all, don't release a statement headed "COMMODORE 128K NOT ON THE WAY OUT". You see, magazines like *APC* will seize upon it, poke fun and generally make you feel more uncomfortable than you already were. END

The Above Board. Your solution to "Memory Full."



Few things are more frustrating than "Memory Full" error messages and the flashing red lights of disk drives as your computer is continually searching for more data. Conventional PC/XT and AT style machines limit software to 640K of memory, causing split spreadsheets, slow response times and major database limitations.

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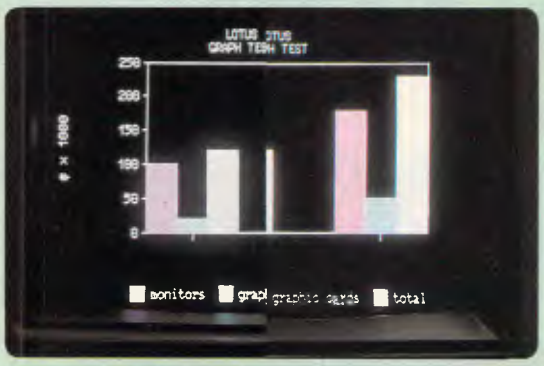

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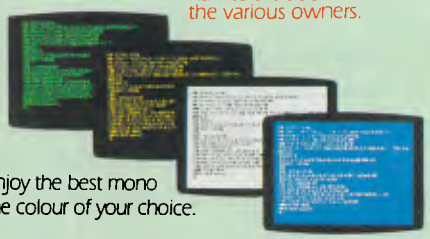

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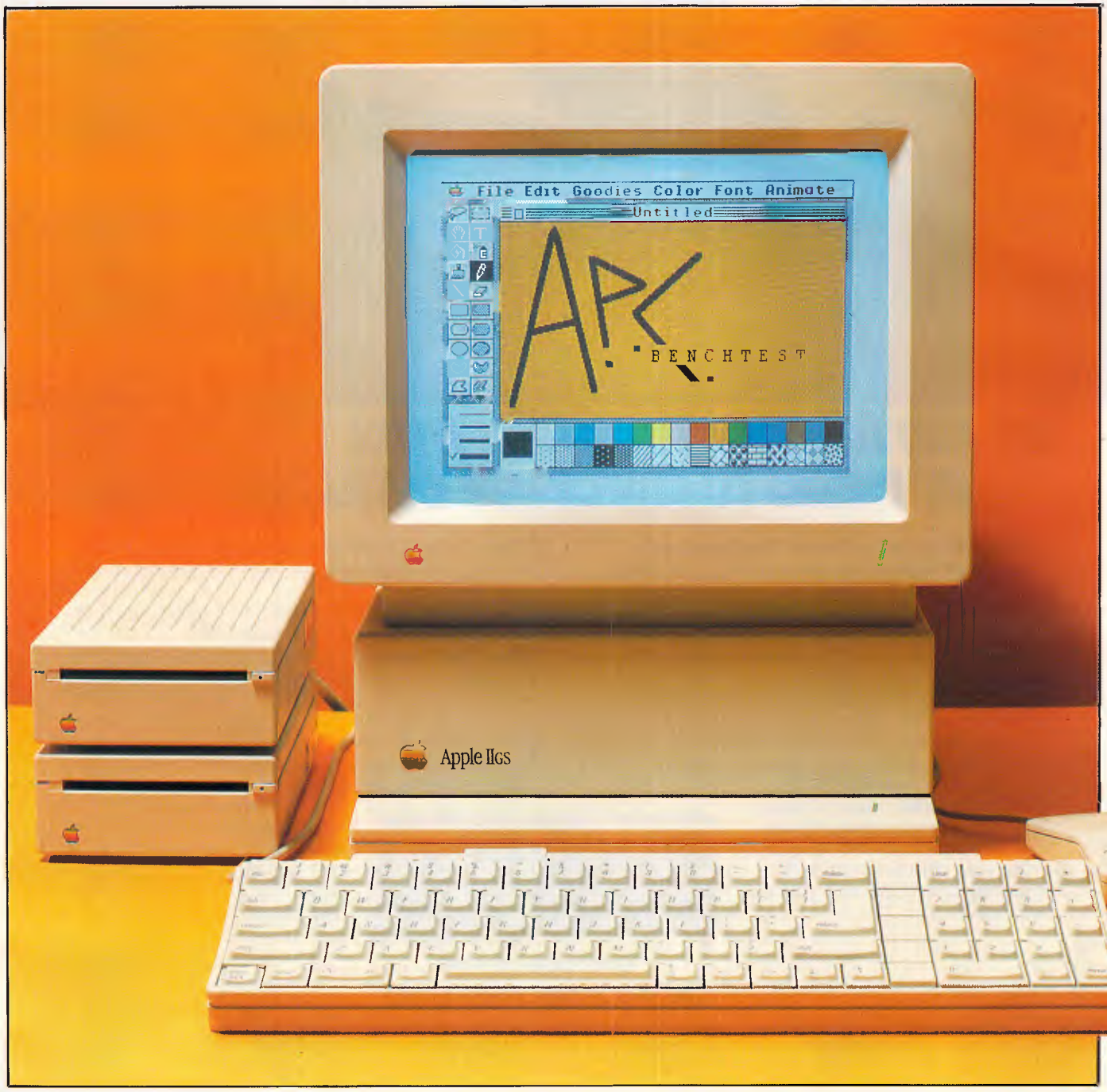
Apple IIGS

What could Apple do for an encore to the omni-present Apple II? Predictably, its successor is 16-bit with a user-friendly interface — but there's no advanced graphics capability and the price could be a problem. Phil Cohen presents this world-first benchtest.



The Apple IIGS is more or less completely software and hardware compatible with the rest of the Apple II range. But it uses a 16-bit processor (the 65C816) which is capable of running software for the 6502 processor used in the rest of the range, either at the 1MHz speed used by the 6502, or at a higher speed of 2.8MHz. The GS can also support up to 8Mbytes of RAM, 3.5in or 5¼in disks, AppleTalk, 640 × 200 colour graphics, and comes with a mouse and a 15-channel sound synthesiser. So to say the least it's a fairly large upgrade step for the IIe.

The GS also comes bundled with mouse-compatible software, and operates just like a big, colour version of the Mac.

This machine is the latest in a long line of machines, versions of machines, upgrades, add-ons and third-party hardware that has its roots in the mists of legend. But before I describe the machine, a little about the Apple company.

In the beginning was the Apple... Apple has been around for almost as long as personal computers (they were called "home computers" in those days), and has a history which marks it not only as a symbol of high-tech frontiership, but also of a certain kind of naivete.

Steve Wozniak and Steve Jobs started building home computers in a garage somewhere in California. At the time, very few people in the electronics or computer industry thought that computers that small had any sort of future, except with a handful of enthusiasts. To take that sort of product and turn it into a Fortune 500 company takes a certain amount of genius, and also a certain amount of idealism. The Americans would say that it was a triumph of the individual; the British that it was a triumph of technology; and the Australians that it was just lucky.

Marketing people see companies as being either 'sales oriented', 'product oriented' or (ideally) somewhere between the two. A sales-oriented company often has a poor product, which it tarts up, advertises widely, sells and distributes well. A product-oriented company is full of boffins; as often as not has an excellent product, but can't sell it because of a lack of selling skills.

In the computer industry, IBM is the symbol for most people of a sales-oriented company. IBM's products are noted for being old-fashioned, clumsy and difficult to use. However, IBM's service, sales support and marketing are excellent. That's not the whole story, of course, IBM's products are not at all bad. But they are not what you would call 'inspired'.

The keyboard is now detached from the system unit

On the other hand, Apple is noted for its exciting and innovative products, but has been known to exhibit a certain amount of confusion when asked pointed questions like: "Who exactly is going to buy this machine?" For many years, the company acted like it was still in the garage, talking nebulously and with much excitement about 'the users' somewhere 'out there'.

With the release of the Macintosh and related products, for example, Apple took a marketing stab in the dark. It released a line of machines with no recognised place in the market, with no accepted idea of who was going to use them, or for what.

The wide-eyed talk from Apple during the Mac launch about a desktop computer being as easy to use as a vacuum cleaner didn't sell the Mac — for 'traditional' desktop applications such as spreadsheeting, word processing and so on, the 'traditional' CP/M and MS-DOS machines are still outperforming and outselling Apple. No, the success of the Mac has been primarily due to the fact that people wanted to be able to integrate graphics easily with text. The market took to the Mac, but not for the reasons Apple planned.

Another curious thing about Apple is that, in direct contrast to *everyone* else in the industry, it didn't think IBM compatibility in its machines was a good thing. Apple has what you might call an ideological aversion to IBM the company, IBM's products and IBM's image. Apple has tried for many years to foster the image of itself as a David against the IBM Goliath.

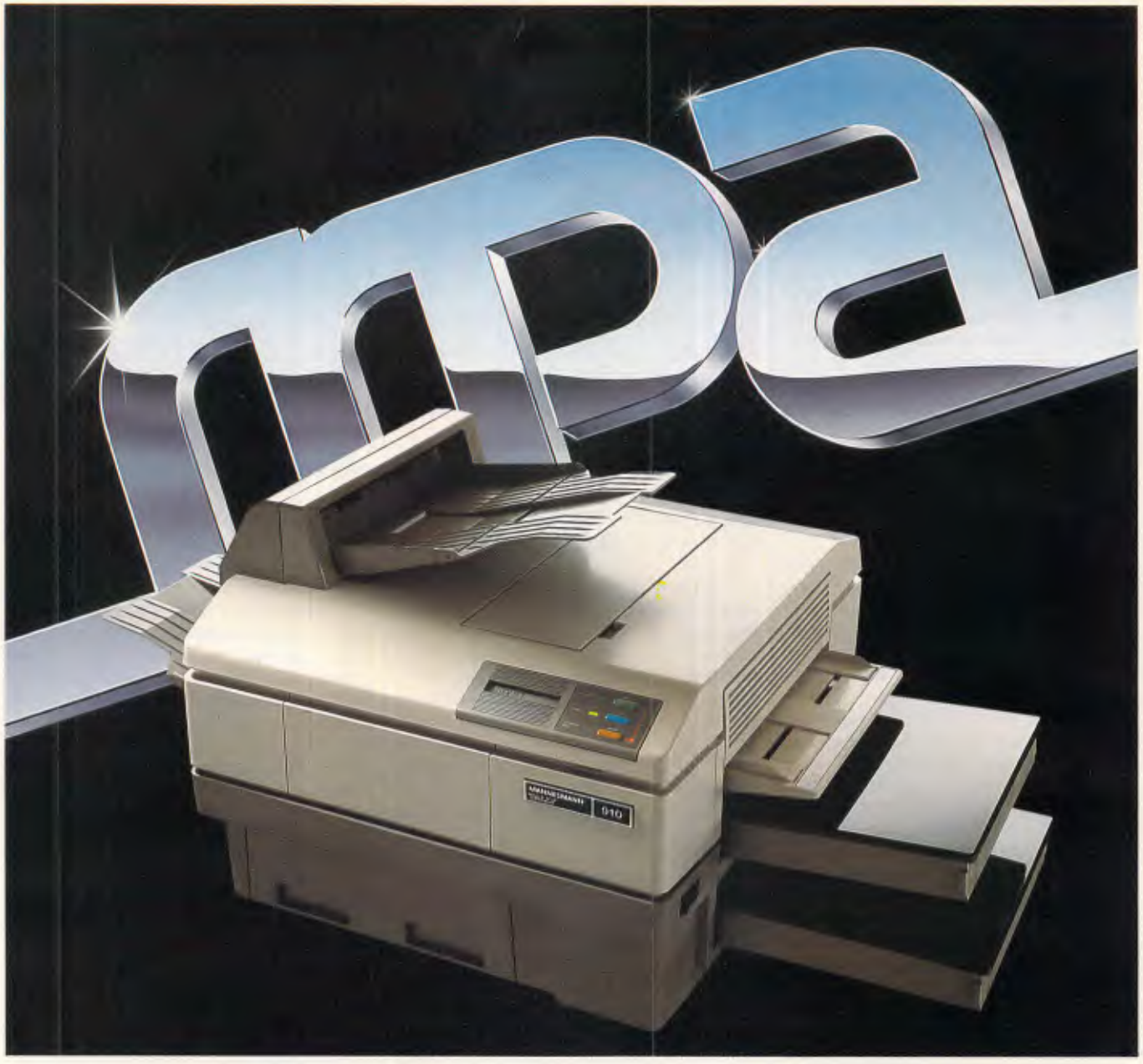
These two Apple foibles — its fascination with the product rather than the market, and its antipathy towards things IBM — have affected this latest step in the Apple II path, as I will describe later. But that's enough about Apple the company.

Hardware

The GS looks rather like an Apple II trying to resemble a Mac. It has a separate keyboard, comes complete with a mouse, and has the Mac's 'sit up and beg' proportions.

Apple users have for years been

Plenty of sockets — even one for headphones!



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MkAdd320

asking for a detached keyboard. Back in the dim and distant past, machines like the Comodore Pet had a keyboard (and *what* a keyboard — more like an instrument of torture) and a monitor built in. That meant that with your hands on the keyboard and your eyes in the right position to view the screen, the rest of you had to adjust itself as best it could.

The Apple II had at least a separate monitor, which meant that you could slide it back and forth across the top of the computer, or even put the odd telephone directory under it to adjust the height.

However, this was far from ideal. The best arrangement is to have a keyboard on the end of a cable, so that the more relaxed users could even work with it on their knees. This is the arrangement the GS uses, with the added bonus of being able to choose which end of the keyboard to plug the cable into. The cable is long enough to be useful too, and has a coiled section.

The other part of the ideal is to have the height and attitude of the monitor also adjustable. Here, the GS leaves you with the telephone directory approach. Disappointingly, the standard monitor arrangement for the GS is to have it sitting on the top of the computer — although I have no doubt that, somewhere out there, a plastic moulding machine is being tooled by a third party to produce GS monitor height adjustors. The GS monitor does have a little plastic foot that can be adjusted, but it's not really effective.

Another feature missing is the front overhang found on machines like the Lisa — you can slide the keyboard in under the front of the computer when you aren't using it. This arrangement is ideal for heavy mouse users, and for offices that are non-paperless. You can't get rid of the keyboard except by sitting it up against the front of the machine.

The mouse plugs into the side of the keyboard. Because of the introduction of something called the Apple Desktop Bus (ADB), you can plug it into either side of the keyboard, depending on whether you are right or left-handed.

ADB is a simple idea — desktop devices like the keyboard, mouse, a graphics tablet and so on, can be daisychained together using a single run of cable. So you can plug the mouse into one of the sockets on the keyboard, and use the other one for the cable that plugs into the computer. To attach a graphics tablet, or any other sort of special peripheral you might want to use if, for example, you are quadraplegic, spastic or have other special needs, you just plug it into the ADB at some point.

The GS's mouse is of the standard Mac one-button species. Other machines use mice with more than one button, but adding another button to a mouse is like going up an escalator the wrong way. Mice are supposed to be easy and intuitive to use, and adding another button or two makes them unnatural and difficult to use. The first stumbling block to using a multi-button mouse is the fact that you can't remember which one does what. As with WordStar's control codes, you can learn in time, and perhaps a multi-button mouse is faster to use than a single-button one, but the learning time (and the number of mistakes made) are not worth the extra speed.

'Looking inside the machine, my first reaction was: "Where's the computer?".'

Apple has broken a lot of the keyboard design 'rules' with the GS, most of which are only necessary for office machines running keyboard-based applications. There's no wrist rest and no means of adjusting the keyboard position, both of which would make the Australian Government think twice about using the machine in an office environment. These are certainly factors to bear in mind if you are thinking of the GS for heavy keyboard use.

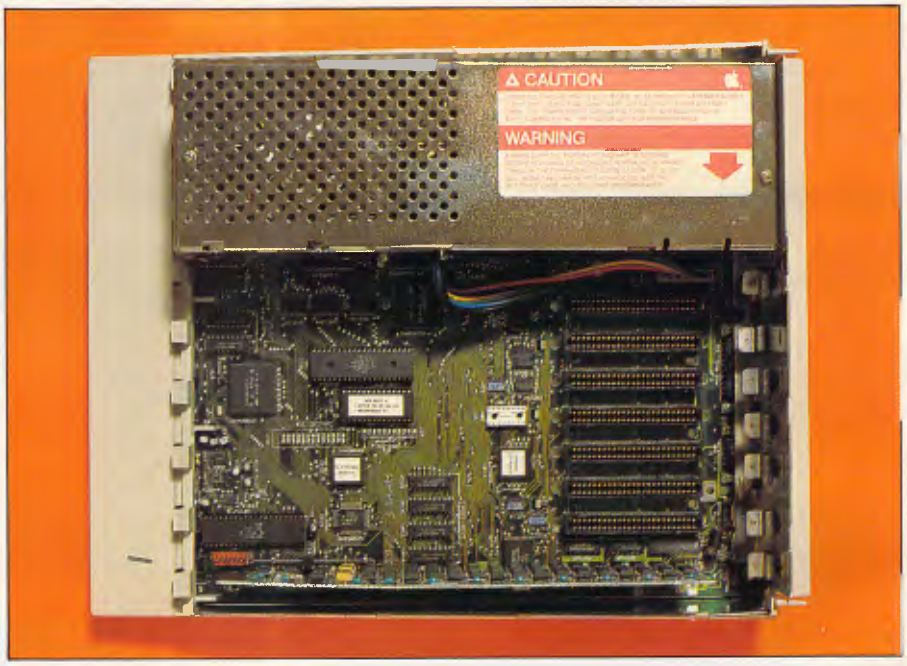
There are no function keys — but with mouse-based applications you don't need them. By running the keys right to the edge of the keyboard, Apple has saved on the keyboard footprint, but at the cost of the wrist rest. The whole keyboard is about 13cm × 38cm.

The keyboard is finished in the same light grey plastic that the rest of the machine, including the mouse, monitor and the matching speakers (of which more later) are finished in. The keytop legends are in black and they are all spelled out — enter, shift, etc — an excellent idea.

There's nothing more frustrating than having to write documentation (as I do) to tell people to press "the key with the down-and-left arrow on it". It is much simpler if all keys are labelled in English, so that the documentation, software prompts and help screens can refer to them in English. It doesn't take long to get used to where the control keys on a keyboard are situated, so having to read them instead of looking for symbols wouldn't lose much time.

The only key on the GS that isn't labelled in that way is the one with the little apple on it (see what I mean?), which is a pity. Why not label it 'Apple'?

Another labelling problem is with the reset key, which is situated well away from the rest of the keys. (How many keyboards have I written about that had a reset button right next to the Return key? Lots.) It does nothing until you press another key at the same time (another good idea). But the label on the reset key does not say 'reset'. Instead, it shows a little arrowhead pointing to the left — why Apple chose that, I can't think.



Surprisingly few chips on the motherboard

THE PC PROBE

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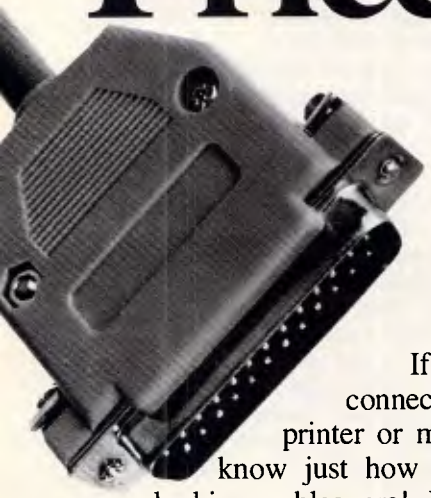
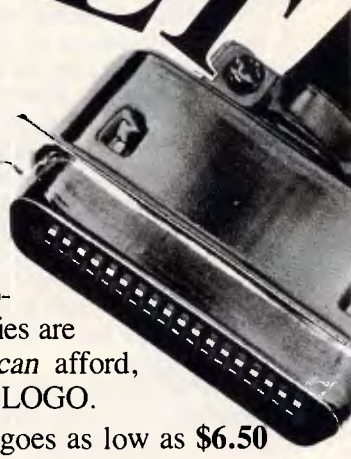


Connecting PC to Printer no longer so Painful on Pocket!



If you have ever had to buy connecting cables to wire up you printer or modem to your PC, you'll know just how expensive those innocent looking cables are! Despite their unassuming appearance, they carry a viper like sting – to the pocket of the unassuming purchaser. Prices range from $50 to $80 each.

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The keyboard is curved, so that the keys at the back point more towards you than the ones at the front. This is a nice touch, but I would rather have had some way of altering the level.

It's rather a fast keyboad, with a light touch. Intended for young fingers, I suppose — the Apple II is very much an education/games machine. It's not bad to work with, and much better than the old keyboard on my Apple II+ which has been hammered so much that it's beginning to creak.

Over the years, the space bar on computer keyboards has been slowly encroached upon by other keys. Keyboard designers, squeezed between trying to fit more keys and keeping keyboard size down, have trimmed successive key positions off each end of the space bar until on the GS it's a mere 8cm long. Eventually it will become smaller still — as all typists have been taught only to use their right thumb to press the space bar, having it extend right across the keyboard is merely a historical accident.

Although the GS keyboard has a numeric keypad, it does not have a cursor pad. Instead, Apple has continued its practice of putting the cursor keys in a row along the bottom. This is very confusing to use — especially at first — but I suppose that is unimportant in a machine that comes complete with a mouse.

The numeric pad has all four arithmetic keys, an equals sign, a full stop, Clear and an Enter. The Enter key does just the same as the Return key on the main keyboard — wouldn't it have been less confusing to label both of them the same?

There's a nice large Return key on the main part of the keyboard, and the Escape key is in a familiar upper left position. The Shift, Control and Tab keys are in the now-standard left most position on the keyboard, and the Delete key is in the upper right. I suppose one day I will have to stop mentioning keyboard layouts in reviews, as they all seem to be converging — the days in which manufacturers used graphics designers with no concept of patterns of use to design keyboards seem to be passing.

The GS does have a couple of differences to the 'standard', though. One is the 'apple' key, which became a feature of Apple II keyboards with the IIe. The IIe had two 'apple' keys in fact, one a white apple and the other a black apple. On the GS the black apple has changed its label to Option.

In fact, the Option key finds the same place on the GS keyboard as the Alt key finds on IBM-compatible machines. It also performs the same purpose — as a third type of shift key (shift, control and alt perform similar functions). If it weren't for Apple's repugnance for things IBM, I suppose the key might have been named Alt.

I liked the choice of shift-lock method.

'Everything clicks together, and Apple tells me that the final assembly process takes seven seconds.'

Many machines currently have a software controlled shift lock, often with an indicator light to show when it is active. Apple has opted for a traditional mechanical shift-lock key, which means that you can tell by touch whether it is active. One day someone will come up with a shift-lock key that has that attribute, and which can be cancelled by pressing either shift-key, too, like the shift-lock on a mechanical typewriter. It shouldn't be too difficult — just use a solenoid in the keyboard. Professional typists would love it.

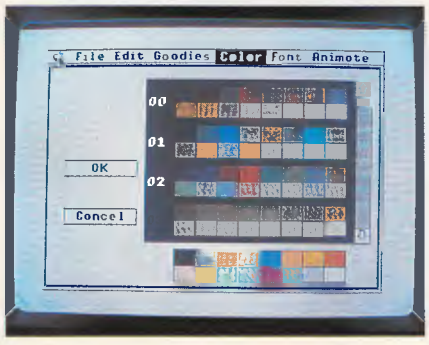
The front of the GS case juts out a little, to accommodate the board inside, giving the whole main cabinet a footprint of about 35cm × 28.5cm. On the part that juts out is the 'power on' indicator, which matches the one on the monitor, near the bottom right of the screen. For applications (such as word processing, computer graphics, etc) which require a lot of screen attention, my first impulse would be to cover the monitor's power on indicator with something opaque, so that it didn't act as a distraction.

However, the use of the same shape of power indicator, the same colouring and general finish (thin slots running front to back) on both the case and the monitor, do give the machine a very neat appearance.

Around the back of the case are some interesting sockets. The first is for stereo headphones, and the next two are serial/AppleTalk ports, which can be configured using the Control Panel software which I'll describe later. Next is a joystock socket (9-pin D type socket), and then a socket for daisychaining disk drives. An analogue RGB monitor socket is next, followed by a composite video output. Finally there's the Apple Desktop Bus connector. All of the sockets are labelled with little diagrams of what they do. If pressed, you could set the whole machine up with no documentation and no knowledge of English just by matching the diagrams on the end of each cable with the diagrams on the equipment.

The last socket looked a little strange to me — marked with the symbol of a chain. When I asked about it, the people at Apple told me that it was for chaining the machine to a desk! Because Apple IIs are built for an educational environment, all of the devices (main cabinet, monitor and disk drives) are fitted with points at which to attach a chain. I suppose the idea is to stop a class of 30 trying to pull the whole thing onto the floor during a heated learning experience. Or perhaps it's to cut down on the amount of theft?

Above the line of sockets (or 'ports' as Apple persists in calling them) is a line of seven cutouts, one for each of the seven card clots inside the machine. Unlike the older machines, each cutout has a neat plastic cover, which you can remove



The Mac-like appearance of the GS screen

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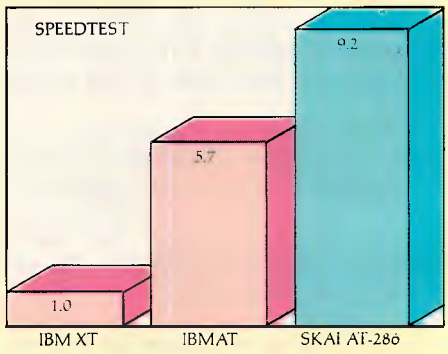

SI Test shows speed relative to the XT.

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without the aid of a screwdriver.

Taking the top off the GS is simple. There are two latches at the back which you push in, and the top is off, giving you plenty of room to play around with extra boards, take out the power supply, or whatever.

The first thing you notice as you take the lid off is that the whole of the inside of the machine, (including the underside of the lid) is covered with a metal screen to cut down the amount of radio frequency radiated by it. Whenever I turned on my old II+, I could no longer pick up the ABC on the television, so RF screening seems like a very good idea.

Looking inside the machine, my first reaction was: "Where's the computer?". There are very few chips on the GS board — even with 256k of RAM onboard.

The power supply simply lifts out of the box (after you press a latch at the front of it), and reveals nothing. After I took out the power supply there still weren't enough chips in the box to make a computer. Very disconcerting.

Apart from the screws that hold the power supply together (which you wouldn't ever want to undo as the power supply operates in switched mode and is therefore potentially very lethal), there literally isn't another screw in the whole cabinet. Everything clicks together, and Apple tells me that the final assembly process takes seven seconds.

The top of the front 'step' of the case comes off, too, to reveal that the power indicator is a LED soldered flat onto the main circuit board, with the light from it being piped up a shaped plastic part to the top of the step. All of the sockets at the back of the machine are soldered directly onto the board too, so that the only flying leads are to the speaker and the power supply, which in any case have sockets.

This arrangement means basically that the board is going to be a breeze to take out and service. I took the whole machine apart using only finger pressure in about a minute, and put it back together again in another minute.

The board layout looks very familiar, as Apple has retained the famous seven slots at the top end (furthest from the keyboard). The machine retains full board compatibility with the older IIs, so upgrading from a IIe, say, to the GS would be a matter of unplugging things one by one from the IIe and putting them into the same sockets in the GS.

The keyboard connectors are still there, even though the ADB does away with the need for them in the GS. Even the game connector is still there.

Other than the sockets, though, the board looks quite alien. Apple has used a multi-layer board combined with custom chips and surface-mount to make something that would scare the hell out of the average technician.

The board is dominated by a small number of very large chips, some of which are mounted directly onto the board, not only with sockets, but without holes for the pins. Surface-mount means that the ICs and other components are simply placed onto the board and soldered. I'd hate to have to try to repair it, but I suppose Apple has that all figured out. *(Apple intends not to replace individual chips which fail, but exchange the entire board — Ed).*

Even the resistors and capacitors are surface-mounted, mainly on the reverse side of the board. There are only a handful of conventional components, and they look very big and clumsy on such a bare board. Although there is 256k of RAM on the board, when I first looked for it I couldn't find it. I was looking for a large area of rows of chips, and instead I should have been looking for a mere four chips in a row. Times do change.

The board is well labelled, and even

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has a coordinate system on it — letters down the side and numbers along the bottom. This will no doubt prove very popular with hardware developers who will be asking GS owners to swap chips, cut links, add components and generally mess around with the innards of the machine. At least, that's what happened with the old IIs.

A lithium battery is soldered directly onto the board, which is going to remove the most common cause of timer failure: bad battery contacts. The battery keeps the internal clock/calendar going, and also serves the small amount of CMOS RAM that the GS uses to store user options set by the Control Panel program.

As well as the seven sockets at the top of the board, the GS has an extra one, near the bottom right. That's for the memory expansion board, which can hold up to an extra 8Mbytes of RAM.

As sold in Australia, the GS will have 512k: 256k on the motherboard and another 256k on the expansion board. Apple will be selling another version of the expansion board, which will give 1.25Mbytes total system memory. However, the processor, the hardware on the motherboard and the system software are capable of supporting up to 8Mbytes and there is no doubt that a number of developers will be producing plug-ins to give just that. The review machine had an Apple 1Mbyte board fitted.

The GS also has 128k of ROM, and can hold up to 1Mbyte of ROM. It can be configured to start up from that ROM, too.

'You can swap files between the GS and the Mac without playing around with disks.'

The motherboard carries the Zilog Serial Communications Controller (SCC) used in the Mac, which handles the two serial ports at the back. AppleTalk, Apple's network software, operates through either of the two serial ports and uses the SCC. This means that you can swap files between the GS and the Mac without playing around with disks.

Although the machine has both sockets on the back and slots inside, the use of them both at the same time is limited. For example, it is not possible to have the printer port operating at the same time as a device in slot one. Similarly, the modem and slot two are linked, as are the mouse and slot four, any 3.5in drive, (if fitted) and slot five, and any 5¼in drive (if fitted) and slot six. AppleTalk uses slot seven.

The monitor supplied with the review machine was an RGB one, and apart from the fact that it had brightness and contrast controls on the side and horizontal and vertical controls on the back, there's really not much to say about it.

The screen is about 27.5cm, and is fairly steady. I did notice a little interference on the monitor of my machine when the GS monitor was on, (but not when the GS itself was on and its monitor was off).

With the GS you have a choice of floppy disk drives, all of which plug into the socket on the back. With the review machine were one 3.5in drive and one 5¼in drive. To attach them both all I had to do was to remove a panel from the back of the 3.5in drive and plug the 5¼in drive into it, then plug the 3.5in drive into the computer.

It is possible to chain together up to two 3.5in drives and two 5¼in drives, and of course Apple's system software will automatically recognise how many and what type are connected.

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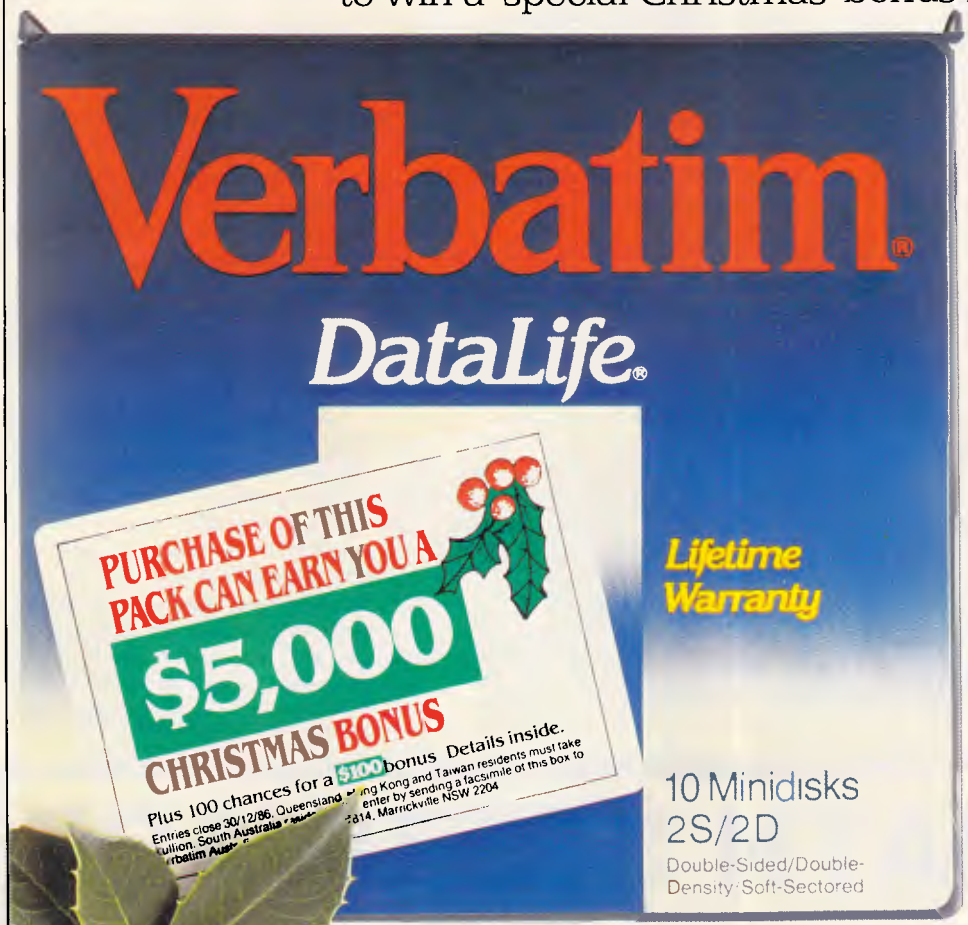

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The 3.5in drive is very compact, and has a motor-driven eject, supplemented by a manual eject with the aid of a small sharp object. The drive capacity is over 800k formatted, and the data transfer rate is around 500kbits per second, which means that in theory it should take around 13 seconds to load a maximum-sized file. However, when I tried it, it took nearly two minutes (copying an 800k file from a 3.5in disk into the RAM disk area of memory: 110 seconds).

Noise from the 3.5in drive is not a problem, although noise from the 5¼in drive might be. The 5¼in drive is compatible with the older II disks, and has a formatted capacity of 143k. It is very noisy, and makes the characteristic start-up clatter of all of the Apple IIs. The drive door is manual and rather clumsy — you have to push the door in to open it. If you use both types of drive for the GS, you will find yourself cursing the 5¼in drive. Copying a 115k file from the 5¼in disk into memory took 104 seconds.

Luckily, in view of the rather slow speed of the floppy drives, Apple will release a 20Mbytes hard disk at the same time as the GS. The Apple Hard Disk 20SC is based around the new ANSI device connection standard for small computers, the Small Computer Systems Interface (SCSI, and pronounced "scuzzy" by some). A card plugs into the GS (or for that matter the IIe) and allows connection of up to four SCSI devices. There are a lot of disk drives coming onto the market with SCSI interfaces, and they are all plug and software compatible with each other.

'It should take around 13 seconds to load a maximum-sized file. However, when I tried it, it took nearly two minutes.'

Graphics speed is important in a market that wants more and more sophisticated user interfaces. The GS looks in many ways to be face to face with machines like the Commodore Amiga. But whereas the Amiga has a dedicated screen handling chip, the GS does not. This means that the poor old processor in the GS is doing not only all of the calculation, but all of the screen driving as well. And it shows in the speed of animation, as well as in the speed of menu pull-down. Having said that, the GS is not *that* slow. But for graphics speed it can't match the Amiga, or the Atari ST for that matter. Even the Mac beats it.

When I asked Apple why they didn't put a dedicated screen handler in (the machine has a dedicated sound chip, which I'll come to later) they were a little vague. First, they said that it would affect the compatibility (which would not have been a problem if they had found a way of bypassing it when running old software) and then they pointed to the extra cost.

Whatever the reason, I can't believe it will be long before a third party remedies the problem — that often seems to be the way of things in Apple II history. The II+ had a 40-column screen and no lowercase letters but when I bought mine I added a card that gave me 80 columns and upper and lower case.

Anyway, the graphics on the GS are fast enough for most things. Apple quite reasonably pointed out that even running 6502 software (and therefore not taking advantage of the extra processor power), the higher clock speed of 2.8MHz on the GS would speed things up considerably.

Goto page 221

In perspective

A little while ago, the big microcomputer debate was over the relative merits of the Commodore Amiga and the Atari ST. Both machines have similar features — excellent graphics and sound, very powerful processors — and each has its staunch following of supporters.

The Apple IIGS is certainly going to be compared to the old Apple IIs, and it will probably be compared to the Mac. Whether the market will take it seriously enough to compare it to the Amiga and ST is questionable.

The big difference between the GS and the Amiga — both machines have similar user interfaces — is the absence from the GS of a dedicated graphics/animation chip; a surprising omission. On the other hand, the GS can call on a software and hardware mountain built up over the years for the Apple II range.

Although the GS has a powerful processor (the 16-bit version of the 6502), it's still a slow processor (with a clock speed of only 2.8MHz). And with a slow processor doing all of the graphics as well as the calculation, the GS does not count as a particularly powerful graphics machine.

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BANKS' STATEMENT

Awaking giant

With company profit margins being eaten into, IBM is preparing to wage legal war against cheap-and-nasty clone manufacturers. Martin Banks presents his findings.

You lot out there have inadvertently created something of a problem for poor old IBM. Among equal proportions of wailing and gnashing of teeth, the company has found that the pussycat of a personal computer industry it playfully pulled by the tail has turned into something of a tiger, and it still has hold.

When you lot out there decided that a largish grey box with a little silver badge on the front constituted a good computer and started buying it, IBM was very happy. To make sure that as many other manufacturers as possible became aware of Big Blue's presence as quickly as possible, the company even exploited its dependence on an outside supplier of operating software and made the PC an open architecture. Within reasonable limits, anyone else could come along and make a similar machine.

Not surprisingly, that is exactly what many of them did, with stunning success. Olivetti added PC-clone making to its existing typewriter and accounting machine business to become one of the biggest suppliers, while Compaq took off from ground zero like a ballistic missile. Unlike the missile, it has avoided both coming back to earth and going 'bang'.

The very success of these and many others has now started to hurt IBM where only IBM can hurt most — the huge black numbers at the bottom of the accounts. What is worse from the company's point of view is that the competition is getting nastier. The likes of Compaq and Olivetti at least play fair — better versions of the PC at competitive but realistic prices.

Now, however, there is increasing competition from Far East manufacturers who have the temerity to ship huge volumes of their clones to these fair shores at little more than cost price.

This poses several questions, many of which will be of direct interest to the average user, not least of which is whether it is actually fair, either to IBM or to the users. There are other questions that stem from this problem as well, such as what will IBM do about it.

This may sound as though I'm about to leap, sword of self-righteousness in hand, to the defence of IBM. I'm not sure that IBM would really feel the need for that, somehow. To defend the company, however, is also to defend the users, possibly against themselves. It wouldn't be the first time that I have written in these pages that the cost of systems has, if anything, to go up rather than down.

Computers are machines that require a certain amount of coddling and support to get the best from them. That, from the user's point of view, is something that comes from the people who made or supplied the system in the first place, and supplying support is, arguably, a moral duty.

Purchasing a PC from IBM or one of its dealers, or indeed buying one of the leading clones from the established names, will get the user this essential support. Certainly, the company won't always be able to solve your particular problems, but even *trying to* is supportive. Most supportive of all is the fact that the supplier has people available to even talk to you in the first place; that can be the single most expensive aspect of the whole subject.

Buying a cheap clone may look good on the balance sheet. A figure of $1500 or $1800 looks a lot healthier to the accountant-brained than $3500 or $5000. Cheap clones may even make sense to some larger users who have full support capabilities on site as a permanent fixture of their own, or those individuals who really do know their way round a circuit board with a soldering iron.

The majority of users are not going to fit into this category, however. They are buying computers, and especially PCs, to solve problems, and having the computer as one of the problems doesn't rate highly. No matter how well a clone is produced (and it has to be remembered that quality control in manufacturing is probably now more expensive than making the things in the first place), you can bet money on failures, faults and problems occurring. All will need more support than is likely to be available on the margins the supplier will be making on having sold the box.

This would seem to beg the question of whether a cheap clone will actually represent the saving it appears to on paper. The answer, on general terms, would seem to me to be no, unless you really understand what you are letting yourself in for.

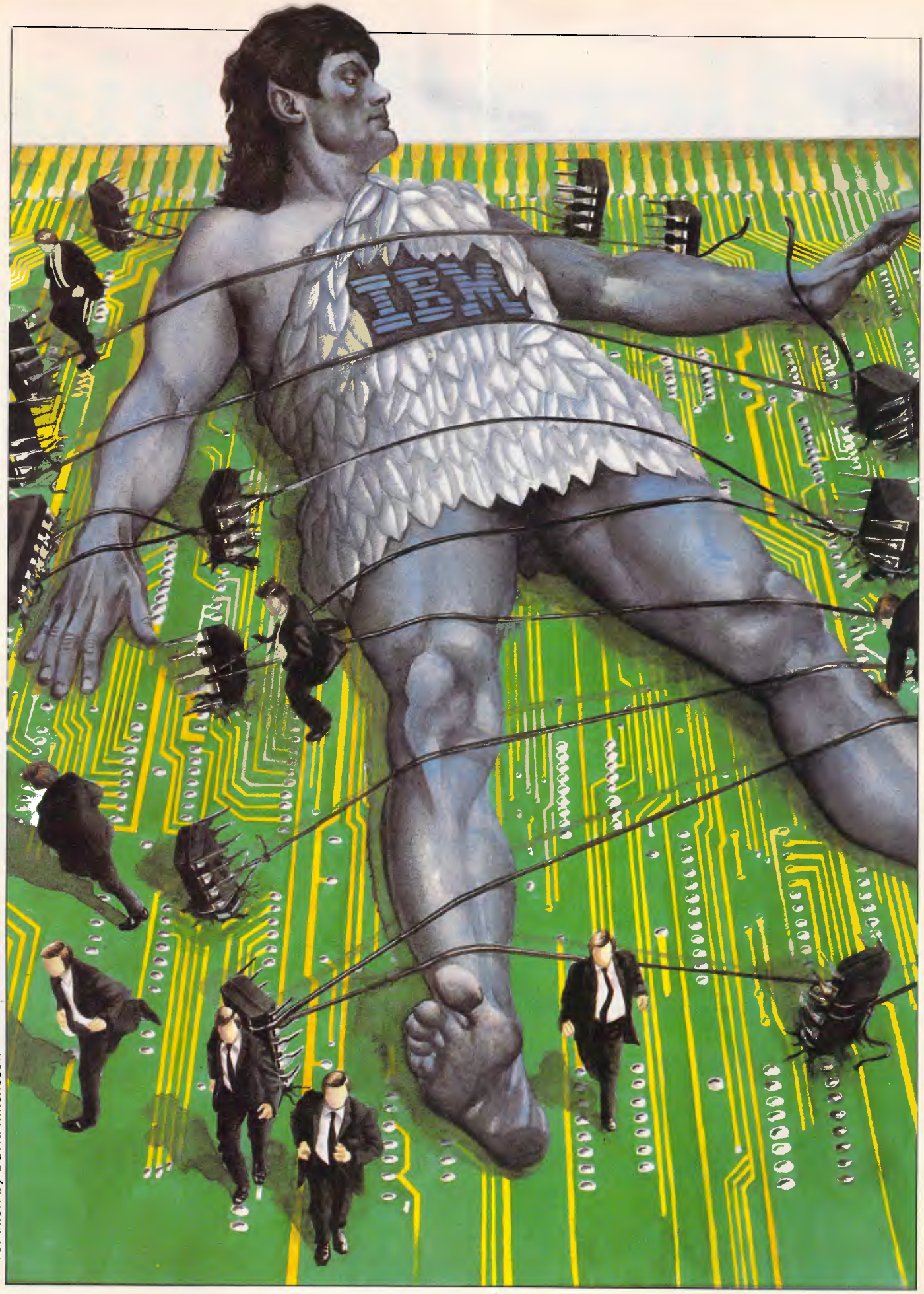
IBM's displeasure at these cheap clones has gone beyond being merely aggravated. Now, the company has decided to take some action. There are strong signs of legal action against some manufacturers, where close BIOS similarities have been noted. This is an area where IBM has successfully used the law for protection in the past. The company is also said to be planning more tenuous legal action on the basis that some clones, the AT ones in particular, look the same as the AT itself. This will make an interesting precedent if IBM succeeds with it.

More important to the user, however, are IBM's plans to make cloning increasingly difficult. There are a variety of ways that the company may approach this problem, ranging from security additions to the hardware, through to similar artefacts in the software.

As the hardware architecture is based on Intel components, there is not too much scope for adding-in bits, even proprietary ones — that will really spook the competing hardware designers. There is some talk of IBM using something like the Intel KEYPROM as some form of IBM identifier, but it might be difficult to both make it work and make it work easily enough not to be more trouble than it's worth.

It seems more likely that the attack will come in the operating system area, perhaps making PC-DOS a bit more proprietary or getting software producers to write applications for proprietary additions to the system, such as the so far unsuccessful TopView.

The real question then might become: Will the users let IBM change things too much? After all, the success of the clone-makers has been based on users liking the existing standard. END



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Apricot XENi

Apricot's go-it-alone approach has proved a disastrous mistake with the sales flop of the portable, and poor sales for the PC and F-series machines. In a bid to defy defeat, Apricot has come up with the XENi, a fast and attractive PC/AT clone. Nick Walker evaluates the machine's chances.

Two years ago Apricot looked like one of the few computer companies which could stand up to the growing dominance of IBM in the business market. Apricot machines made no pretence of IBM compatibility and because of this Apricot was able to incorporate recent technology into its machines. The Apricot PC, for example, was Apricot's answer to the successful IBM PC. With its 3.5in disks, compact design and superior specification, the Apricot outclassed the IBM in every department except one — applications. Nevertheless, the Apricot PC had sufficient of the major applications at its disposal, and sold reasonably well.

Two years on and things don't look so rosy. The Apricot portable machine was written off as a failure, and the PC and F-series machines are not selling in any great numbers.

Apricot has recently announced plans which will, hopefully, pull it back into profitability. All the low-end machines are to be dropped, leaving only the XEN (Apricot's original competitor to the PC/AT) and the subject of this Benchtest, the Apricot XENi.

In some ways the XENi is an admission of defeat for Apricot. The XEN was a step closer to IBM compatibility for IBM but the XENi is an all-out PC/AT clone. The future of Apricot to a large extent rests on these two machines, and the XENi needs to be something special to stand out from the competition.

Hardware

Unlike the PC/AT and the majority of its compatibles, the XENi system box is of a size that could comfortably sit on a desk top. The external casing is exactly the same as that used on the original XEN, a very striking split-level design with a low-profile front panel. However, PC/AT compatibles need to be bulky in order to accommodate a decent number of expansion cards — so there will no doubt be a price to pay for this compact design. The keyboard and monitor continue the angular design of the system box, although both monochrome and colour monitors seem excessively large. All three units are finished in cream injection-moulded plastic.

Setting the system up is simple enough if you have a monochrome system, and it's a relief to discover the size of the system bears no resemblance to the oversized packaging. Part of the reason for the compact size of the XENi is that the power transformer is a large external unit about the size of a shoebox. Initially, I found the idea of an external power supply unappealing, but once it was under my desk I forgot all about it. Additionally it supplies power to both the system box and the monitor, allowing you to run the system off a single power socket.

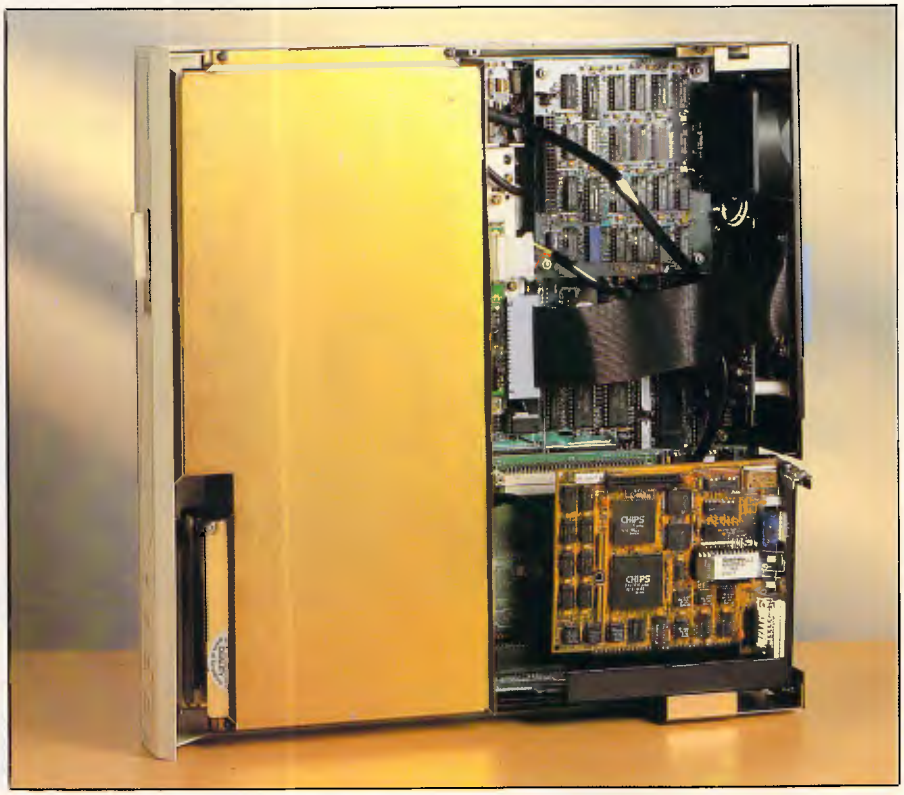
To install one expansion card, six plastic covers must be removed

Purchasers of the colour XENi don't have things so easy. To set up a colour system it is necessary to remove the cover of the system box and install a colour graphics card. In addition to this you must disable the onboard video circuitry by moving a jumper. This wouldn't be too bad were it not for the position of the jumper block, underneath a memory expansion card. To do this you *must* use a pair of snipe-nose pliers, as trying to do it with fingers is practically impossible. Hopefully, prospective purchasers will be able to persuade their dealers to do it.

When *APC* Benchtested the XEN (January 1986) I remember my colleagues being particularly worried about the flimsy quality of the casing. I am pleased to say that the casing is now *very* solid — no longer does the monitor wobble alarmingly when placed on top of the main system unit. This applies to both the XENi and the XEN.

The front panel houses a single 5.25in floppy disk drive, and because of the extra size of this, compared with the 3.5in drives on the XEN, it is not possible to have two internal floppy disk drives. A second external drive is available which attaches to a port at the rear. To the right of the drive there are four LEDs labelled 'FD', 'HD', 'VOICE' and 'POWER' corresponding to floppy disk access, hard disk access, voice telephone call in progress and power. The hard disk lives just behind the front panel though it isn't visible from the outside.

The sides of the system unit are blank



The main PCB is large and occupies all the available floor space

except for a small black reset button to the left. This performs a cold-reset, similar to switching the machine off and on but without danger to the hard disk. For the first four days of this review I was under the impression that the reset button didn't work, but all that is needed is to press it for a *sufficiently* long period. This is perhaps as well because there is some danger of this button being accidentally knocked.

The rear panel houses an on/off switch, a 15-way DC power socket, a parallel printer port, a 9-pin RS232 serial port, a 9-pin Apricot monitor port, a 9-pin IBM monochrome monitor port and the keyboard socket. To the left of the back panel there are six covers for expansion slots. Unfortunately these slots are for Apricot XEN expansion cards which are inserted at 90 degrees to the IBM expansion cards that fit in the XENi. This means that to install just one IBM expansion card you have to remove all the covers. Incidentally while all the manufacturers are conforming to the 9-pin standard for RS232 serial, the *APC* office has found it extremely difficult to find cables of this configuration for both modems and printers.

The top of the main system unit contains what looks like a useful hatch allowing you to add expansion cards without taking the top cover off. Unfortunately this suffers in the same way as the covers on the back; it's designed for Apricot expansion cards and is absolutely useless on the XENi. Getting inside is, however, extremely simple — you just remove two screws at the rear and slide off the top cover and back panel.

The processor at the heart of the XENi is an 80286 (iAPX 286) running an impressive 10MHz. This is the fastest speed I've ever seen the 80286 driven at, and proves wrong the manufacturers who stated that it cannot be driven above 8MHz. For compatibility and timing critical programs the processor can be 'switched down' to run at both 8MHz and the old PC/AT speed of 6MHz. The Apricot XENi uses RAM with an access time of 120ns, which is faster than that on most PC/AT compatibles, so that the processor isn't held up waiting for RAM to get its act together. Even with this faster RAM it's necessary to introduce one wait-state when running at 10MHz. On the base level XENi with a 20Mbytes hard disk the standard RAM is 1Mbyte; the 40Mbytes hard disk version comes with 2Mbytes of RAM. Internal RAM can be expanded to a maximum of 5Mbytes and an external expansion box can take the absolute maximum RAM to a hefty 11Mbytes. Thirty-two kbytes worth of ROM contains the BIOS, the boot-strap and the initial diagnostics.

'The processor is an 80286 (iAPX) running at an impressive 10MHz. This is the fastest speed I've ever seen the 80286 driven at, and proves wrong the manufacturers who stated that it cannot be driven above 8MHz.'

The main PCB is large and occupies all of the available floor space within the system box. Normally most of this PCB is obscured by the floppy and hard disk drives, but I was fortunate enough to be shown a whole system board. The PCB is well designed and tightly packed. A total of nine custom gate arrays are used to simulate functions that would normally require five additional cards on the PC/AT, namely Hercules monochrome graphics, disk drive controller, multi-function card with serial port, parallel port, a real-time clock and a mouse controller card. While the mouse controller card is perhaps a dubious claim, the PCB is certainly more powerful than any other PC/AT clone and has the economy of design to make it relatively cheap to produce.

Considering the density of chips I was pleasantly surprised to find the PCB did not get hot in use. In particular I was surprised to find the processor was not covered in the normal hefty heat-sink used on 80286 machines, and was left to be cooled by the small fan to the upper-right with the rest of the PCB.

The only other PCBs inside the machine were a piggy-back board adding an extra 512k of RAM to the 512k onboard.

There are three banks of jumpers on the PCB that will be of interest to users. The first, which is awkwardly located under the piggy-back RAM, enables and disables the onboard video, the serial port and the parallel port. Before installing an expansion card with any one of these functions it is necessary to disable its equivalent on the main PCB. The second jumper switches the video

output between signals suitable for Apricot's 'paper white' monitor and a normal PC-type green screen monitor. The third set of jumpers set the processor speed between 6MHz, 8MHz and 10MHz. To be honest I would have much preferred all three of these jumpers to be replaced with software switches, or at least switches that don't require you to delve around inside the machine.

Expansion facilities, as I expected, are very limited. At the top right-hand corner of the board there is a removable 'cage' that can hold one IBM PC-type half-size expansion card and two extended IBM PC/AT-type half-size expansion cards. This compares with the typically eight full-size expansion card slots on most AT clones. Even with half-cards I would recommend any cards you intend to use are tested in the machine before you buy them as it is a very tight fit, and certain cards that claim to be half-cards are too big. One of the expansion slots is occupied by an adaptor card that allows you to install the smaller Apricot-type expansion cards. Additional adaptors can be purchased from Apricot.

An external expansion box is available from Apricot which will take three PC or PC/AT-type cards. This is still less than the PC/AT, but is compensated for by the many built-in functions of the XENi.

To the front of the system unit there is a gold coloured cowling that covers both a 5.25in switchable 360k/1.2Mbyte floppy disk drive and a 20Mbytes hard disk drive. Both these drives are of third-party manufacture; the hard disk is the same Panasonic Microscribe hard disk found on the XEN and is still the fastest hard disk installation I've come across. The 5.25in drive, however, is unusually slow. An external 5.25in 360k/1.2Mbyte drive is also available.

One novel feature of the XEN which is also available for the XENi is a telephone handset that attaches to the left-hand side of the keyboard. This is used with an internal autodial modem to provide a replacement for your desk telephone and can also be used for data communications, however, Telecom approval has not yet been given.

Two monitors are available for the XENi, a 'paper white' monochrome monitor, which for software purposes behaves like a Hercules display, and an EGA (Enhanced Graphics Adaptor) colour display. Both monitors are unusually large for their screen sizes. Ergonomically both are nice to use because of an integral tilt-swivel mechanism and anti-glare coating on the screen. The EGA unit needs an expansion card to drive it, which though supplied, is in fact the Quadram half-height board. To my mind the EGA monitor at full brightness was still too dull, but others in the office disagreed and blamed it on me being too used to video game screens!

Benchmarks

BM1	0.26
BM2	1.04
BM3	2.46
BM4	2.48
BM5	2.71
BM6	4.80
BM7	6.24
BM8	7.63
Average	3.45

All timings in seconds.
For a full listing of the Benchmark programs see End Zone.

In perspective

By turning the XEN into an all-out IBM PC/AT compatible, Apricot has joined a highly competitive market. If price is of paramount importance there are many Taiwanese and American clones which are considerably cheaper. Be careful, however, as many of these machines are of dubious quality and have limited support.

The Apricot XENi isn't aimed at the cheap end of the market; it's a front-line competitor in the corporate market and as such up against IBM, Hewlett-Packard, Compaq and the rest. As such it compares reasonably favourably and sales are likely to be determined more by customers' perceived support levels from the machines' respective dealers and manufacturers than minor differences in hardware composition.

I can't see any reason to buy the XENi as a Xenix machine, since you would be paying for too much dedicated MS-DOS hardware. The Xenix option is best treated as a way of upgrading if you want to expand to a true multi-user system. The straight XEN would be a better buy if you want Xenix from the outset.

Two monitors are available for the XENi, a monochrome monitor and an EGA colour display — both are unusually large for their screen sizes

The keyboard connects to the rear of the system unit by a short coiled cable and a DIN plug. The short cable makes it impossible to place the keyboard anywhere but directly in front of the main system unit. Two legs at the rear of the keyboard tilt it at a suitable angle but, unfortunately, doing this lifts the keyboard in line with the 5.25in disk drive. Subsequently the only way to insert a floppy disk is to move the keyboard to the left of the system unit or risk bending the disk.

The F series from Apricot used an infra-red keyboard and on certain models had a voice control attachment. Both these features were almost universally disliked and happily both have been omitted on the XENi.

The keyboard consists of 102 keys arranged in five functional groups. The main qwerty section occupies most of the keyboard with editing keys to the right, and a numeric keypad to the far right.

Running along the top of the keyboard are the 10 function keys needed to be compatible with the PC/AT. I was particularly pleased to see that to the right of these, Apricot has continued to incorporate the six 'microscreen' function keys. Above these six keys there is a small LCD screen that can be programmed to show the function currently assigned to that key. Ever since its introduction on the Apricot PC I've always seen this as a very logical way of designing function keys. On the XENi the microscreen is also back-lit. Considering the size of the screen, back-lighting is unnecessary, but it does give a futuristic blue glow to the keyboard when used in a dark room.

The keyboard on the XEN shows the definite influence of IBM in its design. The XENi as you would expect is a total attempt to create a compatible PC/AT keyboard. In use the XENi arrangement works well and is reminiscent of the arrangement found on many PC/AT clones. After using an IBM PC I particularly liked the independent cursor keys. The Num Lock, Scroll Lock and Caps Lock have built-in red LEDs which light when selected. One thing lets the keyboard down; placing the Esc key in the middle of the top row of keys on the numeric keypad is ludicrous.

I'm going to stop criticising the keyboards of micros as it nearly always boils down to a matter of personal preference. However, the XENi keyboard

The keyboard on the XENi shows the definite influence of IBM in its design

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has a very light 'switchy' sort of feel to it. The J and F keys have little nodules on them to aid touch typists.

Considering so much mouse driven software is bundled with the XENi I was disappointed to discover that no mouse is included with the system. If you want an Apricot mouse it is available, at a similarly excessive price to that of other manufacturers' mice. This is possibly a blessing in disguise as the Apricot mouse is the worst mouse I have ever used anyway.

The problem is that Apricot has tried to combine the functions of a mouse with the functions of a trackball. To use it as a mouse you have to tip the unit up which makes it awkward and cumbersome to use. As a trackball it is far too small and sensitive. Rather than an Apricot mouse I'd recommend a Microsoft mouse which is far nicer to use and works with a greater range of software.

System software

In order to be compatible with the IBM PC/AT the XENi needs to run a version of the Microsoft operating system MS-DOS. The XENi is supplied with MS-DOS version 3.2 which is the standard 80286 version of the operating system as supplied with the PC/AT. While there is doubt that this is the logical choice for compatibility, it is often forgotten that this is really quite a disappointing version of MS-DOS. Although written especially for the 80286, MS-DOS 3.2 fails to take advantage of the more powerful processor commands or the extended RAM available on 286 machines. MS-DOS 4.0 will soon be available, although that version looks no better.

'Expansion facilities are very limited. At the top right-hand corner of the board there is a removable 'cage' that can hold one IBM PC-type half-size expansion card and two extended IBM PC/AT-type half-size expansion cards.'

MS-DOS 3.2 alone is not sufficient to ensure PC/AT compatibility. It is also necessary to produce a ROM that contains a functionally identical BIOS (Basic Input/Output System) as the PC/AT. Sensibly Apricot has not designed this ROM itself, but like so many others the company went to ROM BIOS experts Phoenix Software Inc. I used to be a little disappointed to see the Phoenix ROM BIOS message when booting up a machine, as it suggested that the manufacturer had insufficient facilities to produce one itself. Now a Phoenix copyright message just reassures me as to compatibility.

The combination of MS-DOS and IBM's ROM BIOS limits addressable RAM on a PC compatible to 640k. I'm sure at the time of the IBM PC's design that this was considered more than adequate, but five years on it's a limit more and more users are coming up against. Chip designer Intel has designed a memory-management system for the PC and its clones to get over this 640k limit called 'Above Board'. The XENi includes this system of memory management as standard, so any application that uses 'Above Board' will use all the RAM available on the XENi. Alternatively there is a utility that lets the extra RAM be used as a RAM disk.

Apricot was one of the first manufacturers to take seriously the friendly windowing environments that attempted to make MS-DOS easier to

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System Requirements—System Builder/Report Builder: IBM PC/XT/AT[1], or similar, with minimum 256K RAM, dual floppy drives, or hard disk, color or monochrome monitor, MS[2] or PC DOS[1] version 2.0 or later. Turbo Pascal Version 2.0 or later

[1]Trademarks of International Business Machines Corp.
[2]Trademark of Microsoft Corp.
*Turbo Pascal is a registered trademark of Borland International
*dBASE is a registered trademark of Ashton-Tate.

use. Rather than make a choice between the two major contenders, GEM from Digital Research and Windows from Microsoft, Apricot decided to offer GEM with low-end machines and Windows with high-end machines.

This seemed to me to be a very sensible decision. GEM is the more friendly of the two with greater use of graphics but offers no extra facilities to DOS. Windows is less friendly but has one overriding advantage — multi-tasking. This is the ability to run more than one program at the same time, which is no small achievement when you consider it is sitting on top of a stubbornly single-tasking operating system.

On less powerful machines such as the IBM PC, the ability to run more than one program at a time is no great advantage: the 8088 has enough trouble running one program at a time — let alone two or three. But on a powerful machine such as the XENi, multi-tasking becomes an extremely useful ability.

With the demise of Apricot's lower-end machines I expected Apricot to ditch GEM; not so — the XENi is shipped with both Windows and GEM. It is obvious that Apricot's hopes lie with Windows, but it's still nice to have GEM, as no clear winner of the windowing battle has yet emerged.

Microsoft has collaborated with Apricot and re-written parts of Windows to take advantage of the XENi 10MHz 80286 and the fast hard disk. The XENi implementation is the fastest I've ever seen, capable of running five processor-intensive tasks with no noticeable degradation in performance. Both Windows and GEM are capable of displaying more information than with an ordinary CGA (colour graphics adaptor) because of the higher resolution of Hercules and EGA.

'The Apricot XENi isn't aimed at the cheap end of the market; it's a front-line competitor in the corporate market and as such is up against IBM and the rest.'

Xenix, Microsoft's version of the Bell Labs' Unix operating system, is available for the XENi. The XENi implementation has been carried out by Logica and my brief look at it suggests that the company has done an excellent job. Xenix makes the XENi truly multi-user, multi-tasking, and takes advantage of the processor modes and RAM capabilities which can't at the moment be accessed by MS-DOS.

Xenix is not without its disadvantages however, as the conversion to Xenix requires a different disk organisation which means that your XENi will not be able to run MS-DOS at all. Also, while Xenix is no doubt powerful, its user interface is even more convoluted than MS-DOS and to my mind desperately needs a friendly front-end.

Applications software

The XENi is supplied with a range of applications written by Microsoft, to take advantage of the Windows environment. The full list is: Write, Paint, Terminal, CardIndex, Calendar, Notepad, Calc, Clock and Reversi. It's a sad fact that these applications have never received the recognition they deserve, just because they are only available bundled with the Windows system. As they are written for Windows, all the applications are integrated in the same way as those on the Mac: you can copy a picture from

Paint and then paste it into a Write document.

The most impressive of the bunch is Write, a graphical word processor which owes a lot of its design to Mac-Write. Text can be displayed in a number of fonts and point sizes, and pictures can be integrated into any document. All the usual word processor facilities are available from pull-down menus at the top of the screen. There is support for a wide range of printers and all printing is spooled off as a background task so you can continue to use the system.

Being IBM compatible opens the greatest range of application programs ever available for a single architecture — provided, of course, that the machine is truly compatible. I tried many programs designed for the IBM PC, among them: Lotus 1-2-3, which ran and recognised the 'Above Board' memory; dBaseIII; WordStar 2000; PC Write and Symphony. In a determined effort to make the system crash I tried a number of commercial and public domain games. Microsoft's Flight Simulator crashed, as did two of the public domain games. Overall, though, the XENi rates very highly in the compatibility stakes.

A new version of Microsoft's GWBasic is included with the XENi. Version 3.2 offers Network facilities; improved I/O facilities; directory management; line clipping; windowing; event trapping; keyboard trapping; double precision transcendentals and memory allocation. This all looks very good but I was more than a little disappointed to see that available memory for a program is still limited to 60332 bytes.

In theory the entire range of Unix applications is available for a XENi running Xenix. Most of them, however, still require compiling onto an 80286 system and then transferring onto a suitable disk format for the XENi. My own experience of Unix applications suggests that the majority of them need a better user interface before they will make any significant impact on the business micro scene.

Documentation

The documentation with XENi consists of two ring-bound manuals. The first includes setting-up, system information and a description of GWBasic. The second manual is devoted to a description of Windows. Both manuals are very good, although it took me some effort to find this out as the indexes are ridiculously sparse. I was pleased to see sections introducing the most popular applications.

Prices

Two models of the XENi are available: the XENi HD with 1Mbyte of RAM and a 20Mbytes hard disk retails for $9995, while the XENi XD with 2Mbytes of RAM and a 40Mbyte hard disk retails for $12,750. Unless you already have an IBM-compatible monochrome monitor you will also need to purchase one of these. The Apricot Hercules compatible paper white monitor is $995 and the Apricot EGA colour monitor costs $1559. The CGA adaptor card costs $550.

Peripherals and expansions are priced as follows: 1Mbyte RAM $1995; 80287 maths co-processor $899; mouse $340; and IBM card compatible expansion box $497.

Conclusion

The Apricot XENi is a fast PC/AT clone in an extremely compact and good looking box. However, by limiting expansion facilities and putting the equivalent of five IBM expansion cards on the motherboard, Apricot has, to my mind, slightly reduced the overall appeal of the machine.

The XENi is good value for money, if your requirements are for a fast PC/AT system with 'Above Board' memory management and Hercules monochrome graphics; otherwise it's a lot to pay for good looks and a little extra speed.

END

Technical specifications

Processor:	80286 running at 10MHz, hardware switchable to 8MHz and 6MHz
ROM:	32k
RAM:	1Mbyte
I/O:	Parallel printer, 9-pin serial port, external disk drive, Apricot monitor output, monochrome monitor output, keyboard and power sockets, three half-card IBM expansion slots
Keyboard:	102 keys including six microscreen keys
Display:	Optional white screen Hercules compatible or EGA colour
Mass storage:	20Mbytes hard disk and one 360/1.2Mbyte 5.25in floppy
Operating system:	MS-DOS 3.2 with Windows and GEM or Xenix
Bundled software:	Windows applications: Write, Paint, Terminal, CardIndex, Notepad, Calc, Clock and Reversi.

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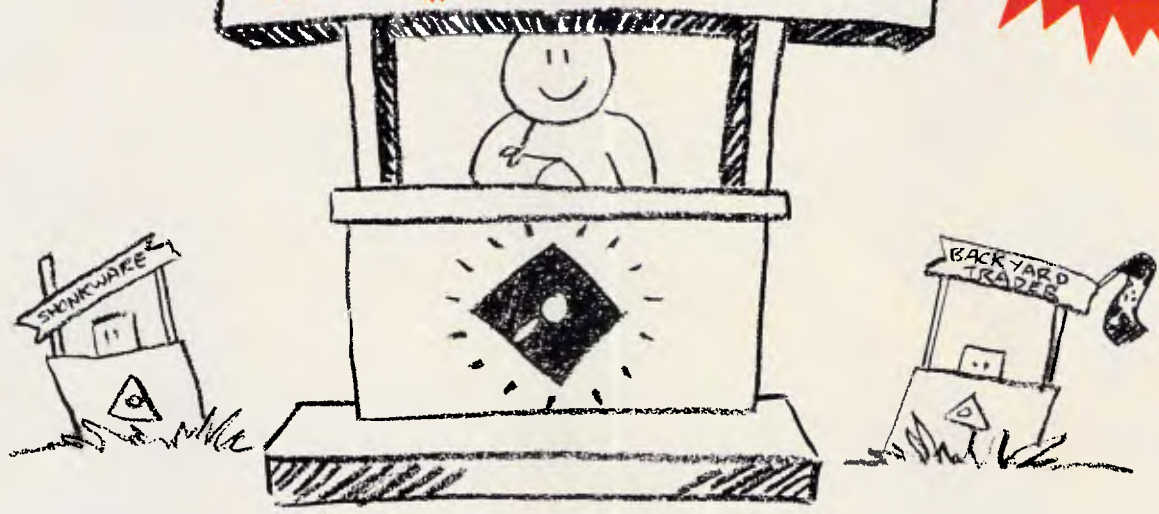

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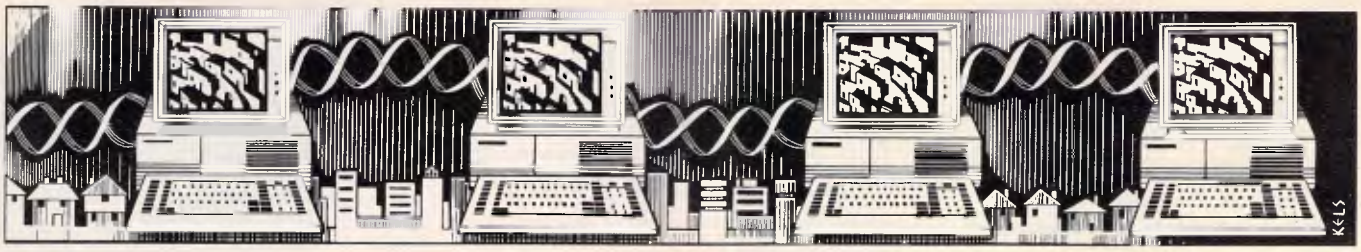

Making nets work for you

Recent announcements mean that powerful PC networks are fast becoming a reality. In the first of a two-part feature Judith Massey looks at their development.

This issue we present two articles, as the first part of our networking feature, which look at recent trends in networking standards and explain the operation of PC-based LANs. Next issue will take a close look at IBM's Token Ring and present a table of available networks.

Networking is one of those subjects, like office automation and electronic mail, that we all think we know about. Every company with PCs knows now that it should have a network of some kind, just as in the early 1980s everyone knew they should have a micro.

But many people are still in the dark about what a network can do, as well as how to install one properly. At a recent conference on networking organised by Ashton-Tate, the majority of the audience felt that they were not being sold what they wanted.

The main reason for this lack of understanding is clearly to do with standards. Until recently it has been impossible to say where networks were heading. Now IBM's announcement of a ready-to-install token ring network has steadied the market in three ways.

The first is that those of you who have been waiting for IBM's product since it was first discussed five years ago, are going ahead with installations. Kevin Leighton, a specialist who installs IBM networks, among others, commented: "We are installing around three networks a week. IBM's Token Ring has forced people to make their decision. They are corporate customers in the main who have been running pilots."

The second group to take action now that Token Ring is here are the applications software companies like Ashton-Tate. "It was purely the question of standards that held the software companies back," Leighton went on.

Lastly, other network companies such as Ungermann-Bass and Novell are strengthening Token Ring as a standard. They are designing software that can run on that system, or producing lookalikes, or manufacturing gateways between Token Ring and their own systems.

Networks let you do two basic things: share data and share peripherals. You can get data from another PC in the office, from another department's network or even from a mainframe. And it makes sense to share expensive peripherals; you get more choice and lower costs.

Although we are concerned here with how to network your PCs, you can trace the technology back to mainframe users in the late 1970s. At that time, the major manufacturers like DEC and Xerox were working on research projects that involved transferring data at high speed between machines. Although the research was useful and produced standards like Ethernet and Arcnet, it had limited success.

Mainframe computers could not be networked productively. But machines became smaller, more efficient and cheaper. People started batch processing, then sharing resources, like printers. The beginning of true networks began when you could link remote VDUs to their mainframe via a modem.

According to Leighton, it took a drop in the price of PCs to spark off any new research. "There were products for the Apple II, such as Omninet, but they were not successful because they were inflexible — it was down to standards again." When IBM's PC appeared, network manufacturers redesigned their products to work on it. But as the earliest versions of DOS could not support true networking, they found little success until the launch of DOS 3.1 in January 1985. At around the same time, IBM announced Netbios — a standard that governs the way application software talks to networks. At last hardware and software manufacturers had a standard to look to and comply with, which considerably aided development.

IBM's grip on the mainframe, mini and PC market means that its strategies set

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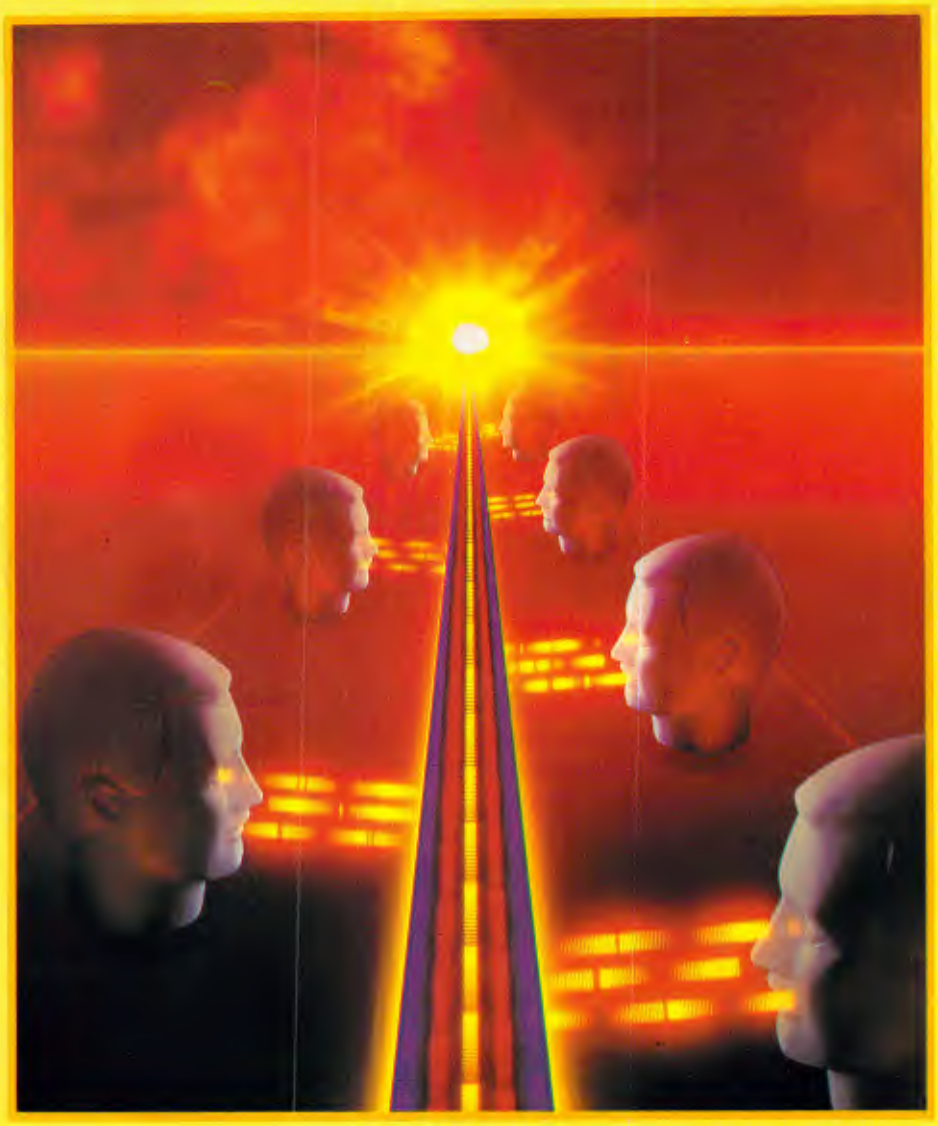

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standards for the rest of the industry to some extent. But there are also standards authorities, like IEEE (Institute of Electrical and Electronic Engineers) and ISO (International Standards Organisation), that have tried to discourage incompatible proprietary networking software and hardware.

The benefits of such systems to their manufacturers are obvious. You are locked into a strategy and must spend your money with one company. Not only are you unable to shop around for the best deal, or the most appropriate system, you are also committed to following whatever path the manufacturer takes in the future.

Standards authorities look for freedom from these constraints for users. They want common strategies from the manufacturers on areas like cabling. Although it may be the least glamorous aspect of linking your computers together, cabling can be expensive and, if not handled properly, disruptive. A common standard would reduce the risk of buying the wrong cabling system.

The IEEE started with two main networking standards, the Ethernet CSMA/CD standard and a token bus standard. Less important standards were token ring (incidentally, it was invented as a concept in the late 1960s by Norwegian scientist Olaf Sonderblom) and slotted ring.

Standard compliance

The ISO involvement in this arena revolves around Open Standards Interconnection, or OSI. IBM's wide area network system, SNA, complies with this standard.

Leighton believes that although IBM is setting standards, it does work closely with ISO: "There is always a parallel between IBM and the standards authorities. Not least because there are IBM representatives sitting on the committees. The authorities do a good job in an unrewarding environment."

Nevertheless, he sees IBM standards dominating the networking scene in the same way that DOS rules the PC world: "Anyone would be foolish to say that IBM has not set standards. Most manufacturers are now following those standards, because IBM has been quite open about how to do so."

The chip set on which Token Ring is based can be bought quite freely from Texas Instruments, so it is easy for manufacturers to follow IBM's lead. The drawback with all this, even though it ostensibly helps you get over compatibility, is that you have your choice of system curtailed.

The major players in the network game have already shown their hands. Ungermann-Bass, one of the oldest established network products suppliers, has come up with Intro/Net. A Token Ring compatible network with similar wiring and adaptor boards, it has a Netbios interface so that you will see no difference between it and IBM's network.

'It is easy for manufacturers to follow IBM's lead. The drawback is that while it helps you get over compatibility, you have your choice curtailed.'

As far as its own proprietary network goes, Ungermann-Bass will provide a gateway between Net/1 and Token Ring or compatibles.

Novell was one of the earliest companies to design and sell networking software. There are around 30 versions of its Netware products on the market. Advanced Netware version 2.00 is Novell's sixth release of its software. You buy it ready installed on Novell file servers, and you can use it to bridge together up to four different networks. The new release supports DOS 3.1, has online tutorials and gives you six utilities.

Because Netware runs on so many different protocols, you can use it to link otherwise incompatible networks like Ethernet and Token Ring by having both sets of software on a shared file server. And the number of manufacturers using Netware is still growing. For example, last years '86 PC Award winner, North Star Computers, chose it for the operating system on its new 100, 300 and 1200 series of multi-user computers.

A spokesman for Novell said that the agreement did not mean a conflict of interest between the two companies. "It's a further step to make Netware the standard operating system on networks. Everyone thinks that the standard in LANs is DOS and that DOS should be extended. But DOS 3.1 is a blind alley for users".

If you buy IBM's Token Ring network you get PC Network software. As you might expect, Novell thinks it is an inferior operating system to Netware. "IBM is interested in the hardware side of networks, rather than the software," Novell claimed. "And it is shackled by its own success — it cannot release anything too revolutionary."

Novell hopes that Netware will become a standard on IBM and compatible networks in the same way that Microsoft's DOS is a standard on PCs. Although IBM is not supplying Netware on its networks in Australia, its US education division is one of Novell's biggest customers.

Novell also agrees with Leighton that IBM's Token Ring has steadied the market for suppliers like Novell: "IBM was slow in recognising networks, but now it has made them credible."

Standards like Ethernet and token ring are dominating the market because they are the best, according to Novell. "We have had the standards for a long time without the industry making use of them," the spokesman said. "But they are meaningless on their own. It takes a major corporation to try everything, then see which filter to the top. And users need to have confidence that their supplier won't let them down."

Bandwagon jumping

Two examples of network manufacturers jumping onto the Token Ring bandwagon are Nestar and 3Com.

Multi-user, IBM PC/XT compatibility

Nestar plans to release a gateway to transfer data between Token Ring and Nestar networks, while 3Com will produce a gateway and a PC adaptor card.

It is only when you look around at the network market that you realise how many products there are to choose from. As with anything else, you need to look at your needs and get the system that will answer your problems.

Broadly speaking, there are four separate areas of networking products. For around $500 per terminal you can make a simple communications network of terminals linked by a circuit of cable. It lets you share data, but you need software that handles file sharing.

Next are low-cost, limited capacity networks. You get file and print sharing for $1000 per station, but there are no gateways to other networks or mainframes.

Thirdly, there are the standard networks like Token Ring and ProNet. These cost around $2000 per station, but you can link in other machines and peripherals, and also talk to other networks.

Last on the list are the alternative standard networks, such as those that run under Ethernet and Arcnet. There are huge installed bases of these systems, and an awful lot of investment in the technology. Only time will tell if they are to be replaced by Token Ring in the future.

In answer to the question of who could benefit from a network, you can almost certainly say anyone with more than one PC. Even if you run a three-person company, you and your employees can benefit from sharing data, or from using an electronic mail system.

And instead of being stuck with one type of printer, or having to carry a plotter or laser printer from one end of the office to another, you will be able to share all of your peripherals between you.

These simple business needs could be met by a multi-user system or a minicomputer, but standardisation means that costs on networks are bound to fall. Plus you can link existing machines instead of buying a whole new system.

Moving upmarket from the fictional three-person company, there are two categories of applications for network users.

The first is the straightforward employment of a system, such as accounting. In these cases a network can replace a minicomputer.

The second is when a group of people use PCs for sharing information on an office system. Again, this splits into two groups of users. One uses packages written in network versions of popular programs like dBase III Plus or Dataflex. The other uses special bespoke software for applications like banking and inventory control.

Problem solving

There are still far fewer applications packages for networks in Australia than there are for single-user PCs. But this is changing — again as a result of the standardisation of network systems.

Lack of software is only one factor that brings problems for users. One of the other more significant others is the shortage of skilled network operators. Leighton recommends that his clients appoint a network manager to look after the whole operation.

'As networks become easier to use and transparent to the operator fewer people really know what is going on in the background.'

As networks become easier to use and transparent to the operator, less people really know what is going on in the background. If you have a single PC, it is fairly straightforward to find out what is causing problems. And as a last resort, you can always turn it off — not recommended for a PC on a network.

This problem can be resolved with the kind of features now appearing on network systems, such as automatic diagnostics and better 'human interfaces'. The future could be even simpler when voice synthesis and recognition start to play their parts — you may even be able to ask your terminal what is wrong with it in person.

The multi-vendor market-place brings its own problems too. Manufacturers bring out hordes of new software and hardware network solutions. Anyone can design and market a system and as Leighton pointed out, many users find reality rather different from their expectations. IBM's standard may lead to a clearer picture.

Future developments

If you accept that Token Ring will dominate the LAN market-place, you have to look elsewhere for future developments. Wide area networking could be the next significant area, while voice and data transmission could improve existing systems considerably.

Minicomputers and multi-user machines can already link into networks. But Leighton believes that IBM may once again lead the way in replacing small systems with powerful PCs. "You have to wait and see what IBM will do with its 6150," he said. "The position is still not clear. If it becomes the next PC and part of IBM's office automation strategy, it could affect its System 36 range."

Integrated voice and data transmission is on its way and IBM is committed to that route. You should be able to transmit information from one part of the network to another by talking into your PC.

The cost of cabling and hardware should continue to fall, removing a barrier for potential network users. Data capture devices like scanners and optical character readers (OCRs) will also get cheaper, and image databases on a network will be commonplace.

Finally, more companies will produce gateways from LANs to wide area networks, public service databases and mainframes. The early promise of powerful networking will finally become a reality.

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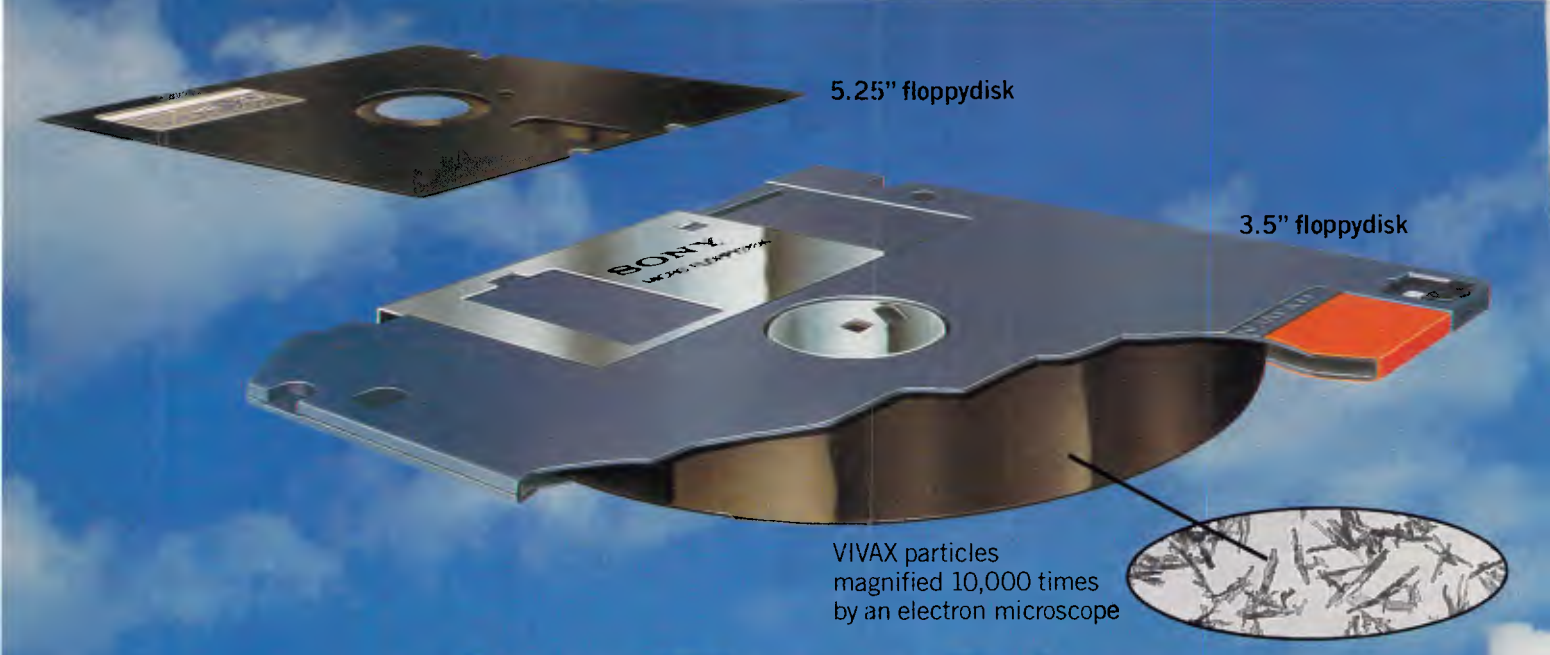

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Local area networks untangled

In the second part of this month's networking feature, Paolo Baccanello unravels the mysteries of LANs and explains how not to get your wires crossed.

The idea behind any network is to organise computers in such a fashion that they can communicate with each other and share valuable resources. Within the PC environment where computers are likely to be located within close proximity of one another, either the same building or those adjoining, such an organisation is known as a Local Area Network or LAN for short.

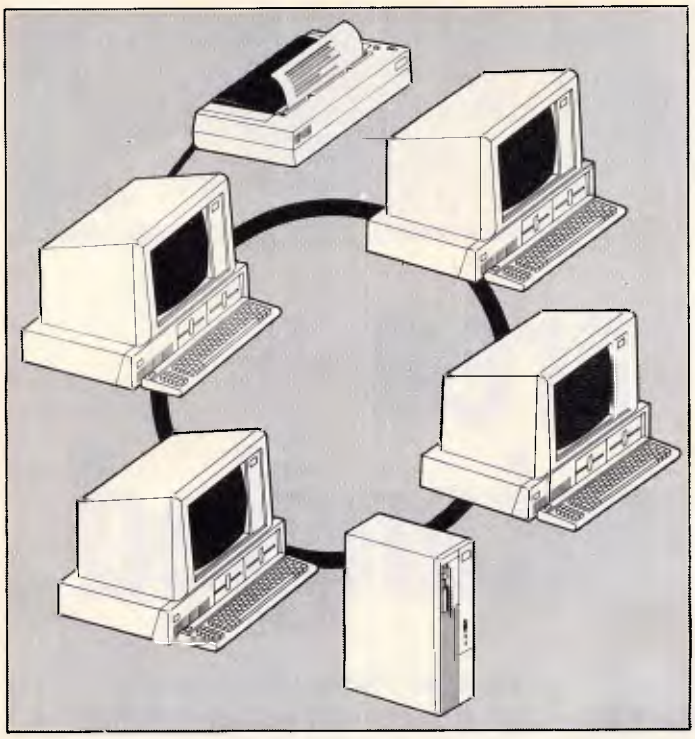
LANs have a widespread appeal. On the computer side they open up the way for distributed processing where each PC, or network station, on the LAN contributes to the successful completion of a particular task. These can include tasks like bringing a ledger up to date or adding new records to the customer database. On the communications front, LANs can complement a company's PABX system providing a much faster and more efficient medium for the transfer of information. They are also a cost effective alternative to expensive one-off data links to the outside world and the company mainframe.

With shared access to disk storage, printers and modems, LANs avoid costly duplication and enhance the performance of existing equipment, thus extending its lifetime. Also, as they can be arranged in any one of a thousand ways; they can be customised to suit a company's internal structure providing an integrated office environment leading to significant increases in productivity.

Cabling systems

If, by their very nature, LANs come in all shapes and sizes, they do at least share certain common characteristics. The first is that all rely on some kind of cable physically to link PCs as well as other devices and to provide the basic transmission medium for information. Cable types fall into three categories. Each one of these has a significant effect on speed and distance at which information may be reliably transmitted.

At the bottom end of the scale in terms of distance and rate of transfer is twisted-pair cable. This comprises two wires wrapped around each other and is commonly used for telephone systems. Twisted-pair cabling has a low maximum bandwidth which means that it is not suitable to transmission rates over 1 megabit/second (Mb/s) over more than 500 metres. It is also susceptible to electrical interference. On the plus side twisted-pair cabling is cheap and easily installed. IBM, incidentally, has an upmarket version — known as shielded twisted-pair. This can cope with transmissions of up to 10 Mb/s over 1,000 metres and is much higher quality. It is, however, very expensive.



Ring topology: traffic is easily spread through system.

Next up the scale, both in terms of performance and price, is coaxial cable. The cable comprises a central copper conductor wrapped in insulating braid. it is not very flexible and so is difficult to install. However, its widespread usage for wiring up TV antennae makes it easily available. Coaxial cable comes in a variety of thicknesses and the thicker it is the more suitable it is for long distance transmissions.

Coaxial cable supports two transmission methods — baseband and broadband. Baseband involves sending single unmodulated signals at high speed over a long distance and will only support digital transmission (including digitised voice). Broadband involves modulating the transmission so that more than one signal — video, voice or data — is transmitted at the same time. As it requires dedicated hardware to convert a computer's digital signals to analogue ones, broadband is more expensive to implement and requires regular maintenance to keep it in tune.

Fibre-optic cabling provides a third option. This is durable, difficult to tap into, and immune to electrical and radio frequency interference. It is also exceptionally fast, with aggregate transfer rates of up to 200 Mb/s which can be time sliced to accommodate a large number of communications channels. It is well suited to industrial LANs and high security systems such as those found in banks and dealing rooms. The disadvantage of fibre-optic systems is that the cable is relatively inflexible and requires expensive support hardware at either end to convert electro-magnetic pulse signals to light signals and vice versa. This makes poor connectivity. For this reason fibre-optics are usually implemented as a high-speed, long-distance 'backbone' on LANs which support more than one cabling scheme.

Topologies and access

As most LANs rely on the use of a single shared line of communication instead of a dedicated line (like say a public telephone system) the way in which information is transmitted differs significantly. Instead of making a connection and then transmitting data to a single location, information is bundled into tiny packets or datagrams which are addressed and then individually transmitted at some mutually convenient time. No mechanical routing takes place to direct the packet to a particular device but, instead, each device (or station as they are better known) along the line examines the package as it goes by and, if addressed to it, reads its contents.

A number of control schemes have been devised to determine how packets are transmitted and cope with packets that have gone astray. Known as protocols, these have a significant influence on LAN performance. The protocols break down into two basic types. First there are Carrier Sense Multiple Access (CSMA) protocols that allow stations to send packets on a first-come, first-served basis. Here stations check to see whether the channel is idle and if so start sending.

Under CSMA, it is possible for two stations to start sending simultaneously and so packets can collide and become garbled. The protocol, therefore, usually employs some kind of mechanism to detect a collision and retransmit the data at some randomly determined interval. This may take the form of an acknowledgement from the receiving station (CSMA/CA) or it may be that the station's own transmission hardware can detect a collision itself by listening to the line while transmitting (CSMA/CD).

Performance under CSMA depends on the level of activity between stations on a LAN rather than the actual number of workstations. Where the level of activity is low, CSMA is very efficient as idle stations do not hinder the rate of transmission. However, as activity increases and more stations contend with each other for access to the line, performance degrades in an unpredictable fashion.

Stations have to wait longer before the line is free and the probability of collisions increases. Time is then wasted retransmitting lost data. On PC LANs where network traffic tends to be concentrated around a file server, this problem may be further aggravated by bottlenecks when packets are sent to the server faster than they can be processed.

Other drawbacks are that CSMA has no priority mechanism and is non-deterministic. This means it is possible for one station to tie up the line when it has a log packet to send, blocking others off from access for a considerable time.

The alternative to CSMA is the token passing protocol. Here, instead of stations competing with each other for access, each waits for permission to transmit. This permission takes the form of a token which is passed sequentially from one station to the next around the LAN. If the token is 'free' a station can append its packet to it and mark the token as 'busy'. Token plus packets are then passed from station to station around the system until they get to whichever station the packet is addressed to. The recipient stores the message, marks the token as 'received' and passes it on. The token is passed on from one station to the next until it reaches the originating station which acknowledges receipt and 'frees' the token before passing it onto the next station.

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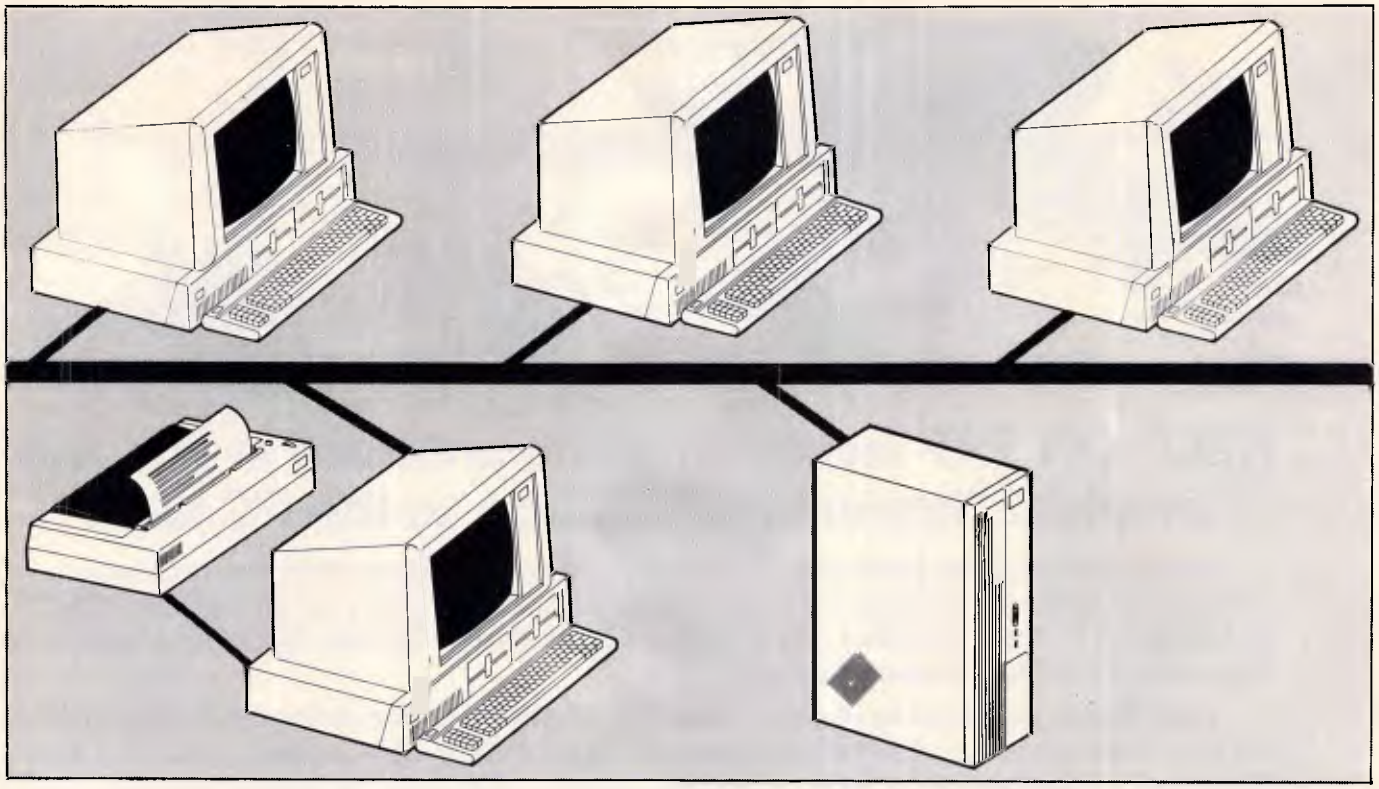


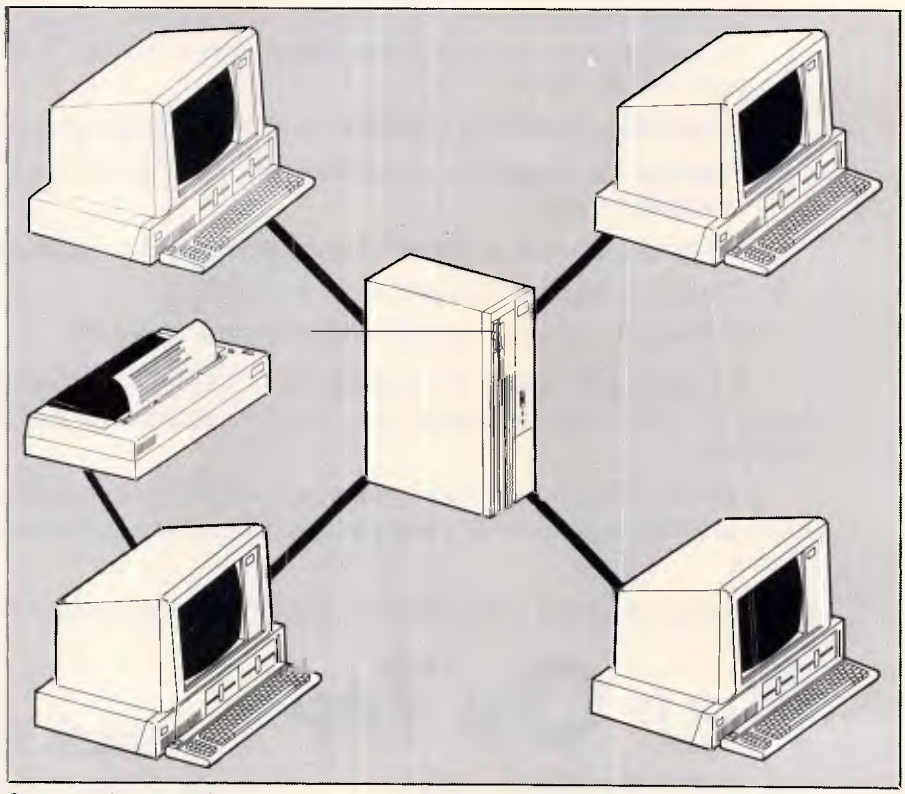
Linear bus topology: stations are strungout along a central coaxial cable.

Performance under token passing depends on the number of stations installed on the LAN, and not on the level of activity between stations. For every station installed, response times are increased by a small and predictable amount as the distance the token needs to travel increases along with the number of times it needs to be repeated. A good analogy is that of a railway journey along a circular track. The more stations there are along the track, the more often the train has to slow down. In the case of token passing, the train slows down at every station though it only picks up from one station every circuit, and from a different one every time.

The advantage of token passing, then, is that once the number of stations is fixed, response times remain constant and network traffic is evenly spread throughout the system. For this reason token passing, though theoretically slower than CSMA, is better suited to networks with very high levels of activity.

But there is one reservation here. This is that, because each station on the network effectively regenerates the token and its attached packet, there is a practical limit to the amount of stations which may be installed on a token passing network before signals get out of synchronisation.

Choice of protocol can affect the topology or lay of a LAN. The token passing protocol can only be implemented where stations are linked to each other in a closed loop or ring. On a ring each station acts as a repeater, retransmitting the packet to its fellow. This means that if one station goes down the LAN goes down, making fault diagnosis very difficult.



Star topology: each station is linked by a dedicated link to a file server.

Take a Look Inside

NEC's new APC-IV provides complete compatibility with IBM's PC/AT but packs a lot more inside.

Looking for Performance?

With a clock rate of 8MHz and no wait state architecture, the APC-IV runs rings around other computers.

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When you're looking for more storage . . .

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CSMA on the other hand can be implemented on a linear bus topology. Here stations are strung out in a line along a central coaxial cable. As nodes are usually electronically aware of each other, information flows in much the same way as traffic on a freeway — with packets getting on and off at nodes like cars at junctions.

The advantage of a linear bus is that it has lower wiring overheads and the attachment of new stations is relatively straightforward. A linear bus LAN will only go down if the central cable is cut or is faulty; it is not dependent upon each station. Cable failures, however, are notoriously difficult to track down.

The most expensive LAN topology is the star configuration. Here each station is linked by a dedicated line to a file server. On this configuration elaborate protocols are superfluous as the central device takes care of routing. The benefits of a star topology are that by using dedicated cables it eliminates bottlenecks and makes for easy fault diagnosis. Disadvantages are that dedicated cabling is prohibitively expensive to implement over long distances with numerous stations. Indeed, on most LANs the file server is usually replaced by a central wiring hub which is either bus or ring-wired to one or more hubs supporting more stations as well as file servers. Such variants combine the benefits of a star topology with those of bus or ring topologies respectively. IBM's Token Ring is an example of such a system.

Another hardware factor affecting LAN performance is the design of the LAN interface card. This plugs into the PC's expansion slot and makes the physical connection between PC and network cable. Such cards can vary from slow, primitive serial-type ports of the kind typically used to link up terminals on a multi-user system, to dedicated LAN-specific cards geared to extracting the maximum performance from the cabling system used.

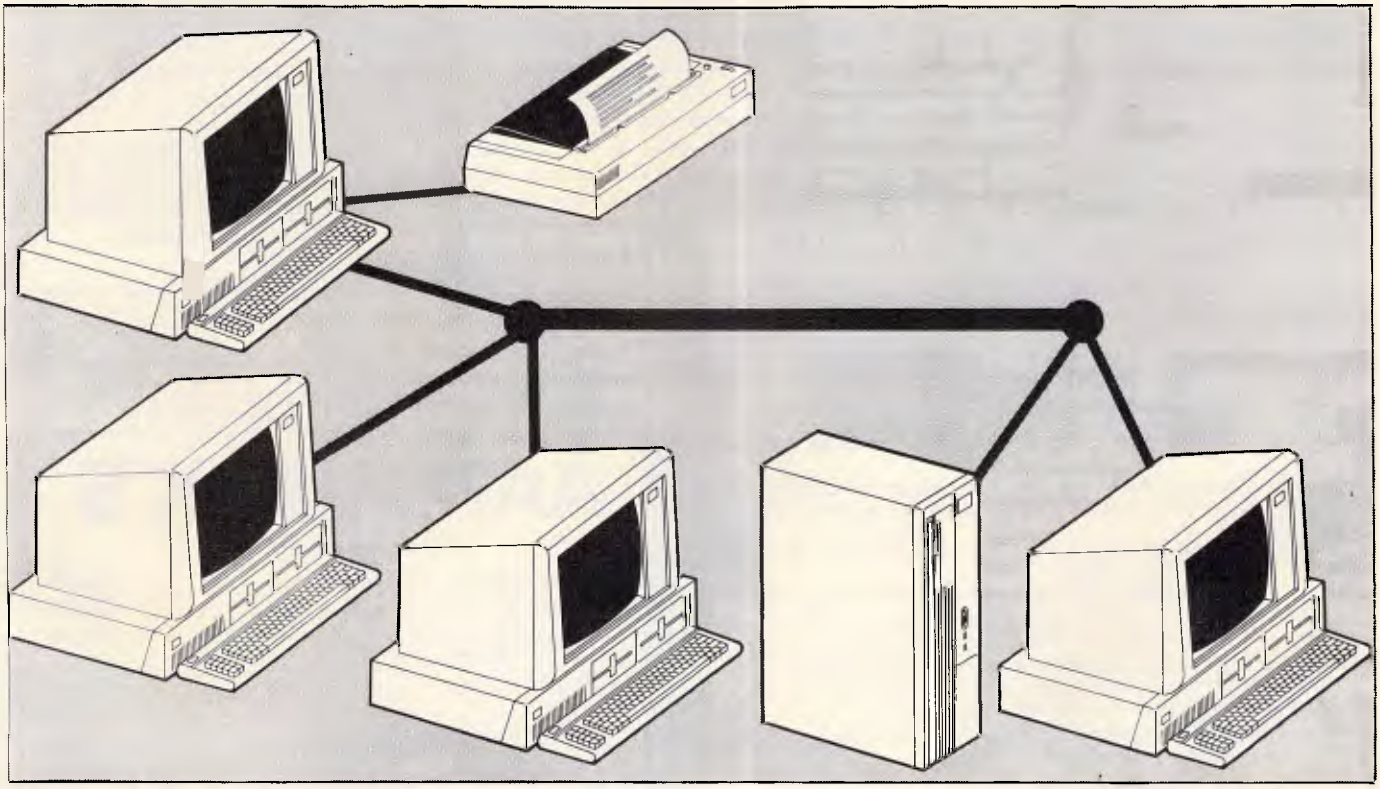
Things you need to check are the speed at which information is transmitted out across the LAN (raw bit rate) and the amount of steps required for the PC to process information received. In the former case, the higher the raw bit rate the greater the network's potential to handle more users. In the latter case the more steps there are for information to be assimilated, the more likely that bottlenecks will arise with packets queuing up to be processed.

Specifications governing the network protocols to be implemented in the design by network interface cards have been issued by the US Institute of Electrical and Electronic Engineers (IEEE) in the hope that they would ensure compatibility between similarly wired networks. The specifications are IEEE 802.3 for baseband linear LANs operating at 10 Mb/s and using Xerox's Ethernet CSMA protocol, IEEE 802.5 for baseband star-wired token ring LANs operating at a raw bit rate of 4 Mb/s, and IEEE 802.4 for baseband token bus industrial LANs operating at 2.5 Mb/s. The IEEE specifications have not been adopted as standard but do provide a rough guideline as to what to look for. However, in the case of industrial LANs the General Motors' 10 Mb/s Manufacturing Automation Protocol looks set to have a more significant impact than IEEE 802.4.

Network servers

Your choice of file server also affects network performance. A file server acts as a centralised storage device on a network which may be accessed by each station. Because of this, network traffic tends to concentrate around it and place a heavy processing and I/O burden upon it. For this reason the file server should be the most efficient device on the network. Certainly an 8088-based PC is unsuitable for the task of servicing the I/O requests of a large number of stations. Ideally, the right kind of machine would be a dedicated device with 16 or 32-bit architecture with a fast processor speed and capable of running concurrent tasks. IBM's PC/AT just about fits into this category.

The hard disk subsystem on the server



Star-wired ring: a file server is replaced by a central wiring hub.

is also important. Because the speed at which information is transmitted across the LAN cannot be matched by the speed at which information may be stored to disk, queues and bottlenecks are bound to occur. The object is to keep these to an absolute minimum.

Fast and efficient disk access, then, should be a primary consideration. On dedicated file servers disk speed is often improved by using multiple disk drives and by resorting to a variety of special techniques. These are geared towards reducing head movement, extracting larger chunks of information and eliminating the rereading of data.

LAN software

The last and perhaps most critical factor to affect LAN performance is the LAN operating system itself. This performs a variety of functions. On a low level it converts data to be sent from a station into raw packet form so that it may be transmitted across the LAN and reconverts at its destination into a form suitable for storage, or for use within a particular PC application.

The software has to decide what information is to be sent, where it must be sent to and how it must be received. It attaches all this information to the packet to be transmitted and reinterprets it when received. The software should also accommodate the station's resident operating system, maintaining data and the program compatibility throughout the system. Additionally on the file server it should handle queuing and be able to cope with bottlenecks. All this should occur behind the scenes without needing your intervention.

The network operating system should also provide any user services necessary for the efficient running of the system not already provided for in the host operating system (PC-DOS). These include network management functions to monitor traffic and reconfigure the system to accommodate new stations and devices, as well as to control messaging, electronic mail, printer spooling and LAN security.

An important consideration in choosing a network operating system is whether it requires the use of a dedicated file server, or whether the file server can double as a separate station on the LAN. This depends on whether the network operating system runs as an application under PC-DOS — as an accounting package or database program for instance — or whether PC-DOS runs as a concurrent task under the control of the network operating system. If the system runs beneath PC-DOS it is subject to its limitations and until PC-DOS evolves into a multi-tasking system, it will require the use of a dedicated file server. A further disadvantage is that all network requests must first go through PC-DOS before they are dealt with by the network operating system, which slows down the LAN's performance.

When you choose the network software it's also worth considering whether it is hardware independent, or whether versions of the software are available to run on LANs with different architectures. This is particularly important in the area of inter-networking, as it provides a common user interface between LANs, thus simplifying the task of network management.

Other areas to look at include finding out if the LAN recognises different users as well as different stations, as this has important implications in terms of security and network management, and discovering whether the LAN extends PC-DOS 3.1 files and record locking schemes, and access permissions. For example, you should check to see that the software can cope with 'orphan' locks, when a record or file has been left locked by a user who is no longer on the system. There is also the problem of 'deadly embrace' when users lock each other out from portions of a shared file and are unable to exit without the other user first unlocking his or her portion.

Gateways

One final area to look at is that of gateways and bridges. Those that lament the absence of concrete standards for LAN hardware or software often overlook the fact that LANs are by nature flexible arrangements that can be moulded to suit any purpose. For this reason variety rather than rigid standardisation is to be preferred.

Different wiring schemes, topologies and protocols have their own unique merits as well as disadvantages. When choosing a LAN it should be remembered that the important thing is not that LANs should be physically identical, but that they should be able to communicate with each other. For this reason, communications servers which provide gateways to interconnect LANs of different architecture, as well as bridges that interconnect LANs of the same architecture, are vitally important.

LAN interconnection, however, is in its infancy and the choice of gateways is limited to the X25, which allows connection to WANs (wide area networks); the X400, which provides access to global electronic mail services, and SNA, which permits entry into the IBM mainframe world using APPC/PC. Fortunately, the appearance of dedicated communications servers of equal sophistication to file servers implies a massive expansion in this area.

APC's networking feature continues next month with a guide to available networks and details of IBM's Token Ring Network.

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YANKEE DOODLES

David Ahl reports on the Software Engineering Institute which has been set up to create and modify new software, plus the rest of this month's American news.

Fuel for the fire

If computers represent the engines driving the most important technological revolution in history, then software is the fuel. Therein lies a paradox: as software fuels this revolution, it also impedes it and threatens to explode it. Software has proliferated faster than computing experts' understanding of it; and society's increasing dependence on software has caused a wide array of intractable problems, not only in computing but also in law, economics, management and education.

Recognising this problem, Carnegie-Mellon University's new Software Engineering Institute (SEI) was established to mount a broad-based attack on the software crisis. Funded by the Department of Defence and supported by corporations, universities and government agencies, the SEI will serve as a catalyst to a larger effort among these groups to:
1) develop new tools and technologies for creating and modifying software; and
2) accelerate the transition of these tools from development to practice.

Underlying the projects at the SEI is the so-called 'software factory' concept, which is already in use in Japan in prototype form. A software factory is a continuously evolving software development environment in which software project managers standardise, measure and analyse literally all the activities that are involved in building software projects — from the very basic design of what the software is intended to do, through integration, to components testing, deployment, evaluation and even modification in the field. Only through this preservation of corporate memory' can the software specialists fully exploit what they learn — for example, by reusing a section of code in particular, and the know-how acquired during the project in general.

SEI technical projects are intended to increase both management and technical control of large-scale software engineering products, and to provide technology intensive support for all aspects of software engineering. The SEI will also be establishing requirements and developing modules for a university-level software engineering curriculum, and working to find solutions for legal licensing and protection of software. Stay tuned.

IBM strategy

With the growing success of the IBM PC clones, reportedly inching up to 25 per cent of the market from 10 per cent a year ago, IBM is fighting back. Its first move was an 18 per cent price cut in July. Currently, many clones only undercut IBM's prices by about 15 per cent, and some of these makers will have trouble making a profit if they must lower their prices another 18 per cent or so.

But some clone makers still have a tremendous advantage over IBM, which buys 70 per cent of the components of the PC from outside the company.

It is to combat these clone makers that IBM is considering a proprietary operating system for the new 80386-based PC. The system would be able to run existing PC software, but to get the full benefit from it you would have to use specially-written software which — surprise — would not run on rival systems.

Another area in which IBM intends to distance itself from clone makers is in PC-to-mainframe communication. IBM knows its own big machines best, and clones won't be able to copy the IBM hook-ups fully or immediately. IBM initially lost ground in this market by not offering a 3270 board for the PC; instead, the company offered the 3270 PC which has not sold well. Now, responsibility for the 3270 PC has been taken from the Communications Products Division and given to the Entry Systems Division (marketers of the PC itself), a move that will probably result in IBM offering more 3270 options on the PC and phasing out the 3270 PC.

This move will also lead to the development of applications which execute partly on the mainframe and partly on the PC. This is a major undertaking and it isn't likely that clone makers will be able to duplicate it easily.

In the fast lane

In late 1984, the Penske Racing Team installed two Computervision CAD/CAM systems at its design and testing facilities in Poole and Northamptonshire, England. At Poole, these high-resolution colour systems are used to create 3-D chassis models that allow analysis of stress points, deformation, suspension geometry and component interference. The systems are also used to produce accurate scale models for wind tunnel testing.

The first results of this work led to completely redesigned wings, flaps, airfoils and underchassis on Penske's Indianapolis-type cars in the 1985 season. These cars won both the 1985 Indianapolis 500 and the CART (Championship Auto Racing Teams) National Championship.

Additional computer analysis was done on the 1986 cars, specifically in body design, and the kinematics and dynamics of the suspension.

Mid-way through the 1986 season, the Penske PC-15 car driven by Danny Sullivan was running second and Rick Mear's PC-15 was running seventh — not bad for brand new computer-designed cars.

Random bits

The Computerland BC 88, the company's PC clone, uses an old idea from the earliest S-100 bus personal computers: it has no motherboard. The base unit is just a box with a plug-in bus and a 150-watt power supply. You can plug-in any processor board (8086, 80826, and so on), controllers, display drivers and peripherals you want. Best of all, its modular design means that it will never be obsolete ... Centronics Printer Corp has made its long-awaited entry into the non-impact printer market with a low-end ($US2495) laser printer, the PagePrinter-8. Using a 68000 chip and a Sharp engine, it prints eight pages per minute with a resolution of 300 dots per inch ... Quarterly profit at IBM was down 7.7 per cent on a 7.3 per cent increase in revenue to $US12.3 billion ... Sparked by strong Macintosh sales, Apple's sales increased 20 per cent in the spring quarter with earnings up correspondingly ... MicroPro software (WordStar, Easy, and so on) is now being distributed by an interactive videodisk system made by Instant Software Generation. In the store, the customer can view a brief video presentation outlining the highlights of the product, and, if desired, explore it further and have it duplicated onto a floppy disk right on the spot. Four pilot systems are now in operation ... MicroPro is also, in cooperation with Island Graphics, developing Prism, a desktop publishing product due for release by the end of the year ... Keyword Office Technologies of Alberta, Canada has introduced Keyword Softpak ($US449) for the IBM PC and compatibles, which allows users to interchange documents created by different word processing systems. A multi-window, menu-based user interface guides the user through the process ... Microsoft Corp has released QuickBasic 2.0, a Basic compiler with many advanced features such as multi-line IF statements, alphanumeric labels, interactive error detection and correction, and an interactive editor.

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Omnis 3 Plus

Omnis 3 Plus is an easy to use, powerful system for the Apple Macintosh which enables the development of sophisticated systems. Kathy Lang takes a closer look.

The Omnis family of data management packages has been established in the market longer than most. In its earliest form, it was a 'flat-file' (one set of data handled at a time) package for the Apple; since then, it has been implemented on a variety of systems, but until recently under the UCSD-p operating system. The extent to which that system was less popular than CP/M, and its subsequently virtual eclipse on business systems by MS-DOS/PC-DOS, account in large part for the rather low profile that Omnis may have had in the business market. Nevertheless, since the release of Omnis 3, a powerful package capable of handling up to 12 data files at a time, the package has been steadily gaining ground on conventional business systems.

Last year, as a natural progression from the Apple, Omnis 3 was released for the Macintosh, and has proved a substantial success in the US as well as here, being regarded by many as the most powerful database system available for the Mac. An upgrade of the Mac version, called Omnis 3 Plus, has just been released.

Omnis 3 Plus applications consist of two kinds of file: one or more data files holding the information, and one or more library files storing the 'blueprint' for the data and its processing, including data file formats, entry screen layouts and report specifications.

The package is unusual in allowing very large files (up to 160Mbytes on the Mac) that can span more than one disk. Up to 12 data files can be linked in an application, though this limit can only be reached if you do not need to use indexes to retrieve records directly other than through file linkages — the limit of 12 is on the total of file linkages and indexes in one application.

It is possible to use Omnis 3 Plus in its 'native' mode, and in that form you have the full facilities of the package available, but they are not specially tuned to your requirements. You can also exploit Omnis 3 Plus's rather unusual approach to building tailored applications. This essentially involves modifying the basic features so that they operate in a way specific to a particular application. Especially on the Mac, where the package exploits to the full the features that make the Mac so easy to use, this approach makes it possible for relatively inexperienced users to build powerful systems, without as great an investment in learning as is necessary with many of the packages that use a full command language.

Omnis 3 Plus is essentially a menu-driven package; a basic set of menus is provided, but you can also construct your own. Throughout, the package is driven in the usual Mac fashion, making full use of the mouse but with keyboard equivalents for the most frequently used functions.

For some people, the fact that Omnis 3 Plus is copy-protected will be a drawback. The approach used is unusual, however; the package is normally loaded either from a working copy of the system disk or from the hard disk, and the validity of your original system disk is checked only occasionally — 'three or four times a month' according to the manual. This should diminish the chances of failure in this area causing serious problems.

Constraints

The main features and constraints of Omnis 3 Plus are shown in Fig 1. Apart from the limit to 12 files plus indexes in one application, the other noticeable constraint is the limit to 79 characters for text fields. In this latest version of Omnis, however, it is now possible to link several character fields together, so that they work as one for data entry, with word-wrap from one to the next. Each field would still, however, need to be mentioned explicitly in a search.

File creation & indexing

The first step in creating a file is to set up a format for it. This includes naming fields and defining their lengths and types, specifying indexes and file connections. At this stage, you must estimate the final size of the file (though it is possible to expand this later); Omnis 3 Plus then sets up a file area large enough to hold the total records envisaged, to avoid the danger of running out of space later at a critical moment. The second phase involves creating one or more entry formats for the data file.

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BELL 103, BELL 202, CCITT V21, CCITT V23 (Mode 1) 600 baud half duplex, CCITT V23 (Mode 2) 1200 baud half duplex with or without an equaliser, Videotext 1200/75 or 75/1200 (switched), Power supply and telephone included, Standard RS232C interface or connects to user port (Commodore version).

RS232 version:	$279
Commodore 64 or 128 version:	$299
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Max file size	160Mb
Max no fields	120
Max digits	11
Special disk format?	
Link to ASCII files?	Yes, can vary formats
Fixed rec structure?	Yes
Amend rec structure?	Only by copying data file.
Link data files?	Yes
No sort fields	9
Max key length (chars, fields)	79,1
Data validation	Good
Unique keys	Optional
Store calculated data	On input, or updating in batch; batch process to change specified fields/ records.
Store selection criteria	Mandatory
1 criterion/field?	Yes
Browsing methods	Any field for viewing or editing
Reference Manual+	****
Reference Card+	****
Hot-line?	Yes
Max record size (chars)	Memory limit
Max field size	79
Max prime key length	
File size fixed?	Yes
Data types	Numeric, character, date, time, logical and money format
Fixed record length stored?	Yes
No data files open	12
No keys	12
Subsidiary indexes kept up-to-date?	Kept up-to-date automatically
Screen formatting	Paint-a-screen
Report formatting	Paint-a-screen; default format supplied
Totals & statistics	Totals and sub-totals
Combining criteria	AND
Wild-code selection?	Field may contain specified character(s)
Interaction methods	Menus, commands, limited tailoring
Tutorial guide+	****
Online Help+	***

Fig 1 Features and constraints

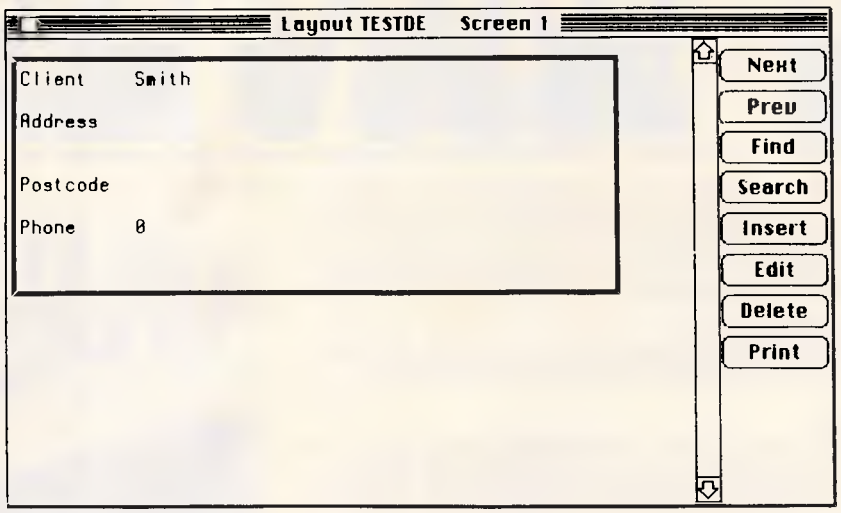


Fig 2 Default menu options on data entry screen

entry formats. These are created through a paint-a-screen process, in which you may create a maximum of 12 screens for any entry format, including references to up to 12 files, and a maximum of 120 fields. If the format spans several screens, you can scroll through them using the Mac slider and scroll bars.

The normal case is for one record from each file to be displayed in an entry layout. In some circumstances, you might want to display several records from one file, perhaps to show all the records about the children of a household, alongside a single record containing information such as the address and other data which is the same for each child. To cope with this situation, Omnis 3 Plus provides a temporary array, stored in memory only, into which a group of records can be read before display, and from which the file can be updated after editing.

Omnis 3 Plus provides a wide range of attributes to be used with data entry fields. These include the ability to attach a message to a field, to calculate its value, to supply a default value, to protect its contents from deletion, and to make a field invisible or display only. An indexed field can be checked to ensure unique values; other kinds of data validation are also possible, through checking features that are also attached to the entry format. Putting these checks on at this stage, rather than on the file format specification, does oblige you to repeat the checks if you have more than one entry layout that can update a particular file.

To locate records for amendment, you have several options. An indexed field can be used to locate a record in two ways. You can invoke the Find option from a menu, and then enter a value in an indexed field. Or you can designate an indexed field as 'Autofind' when the data

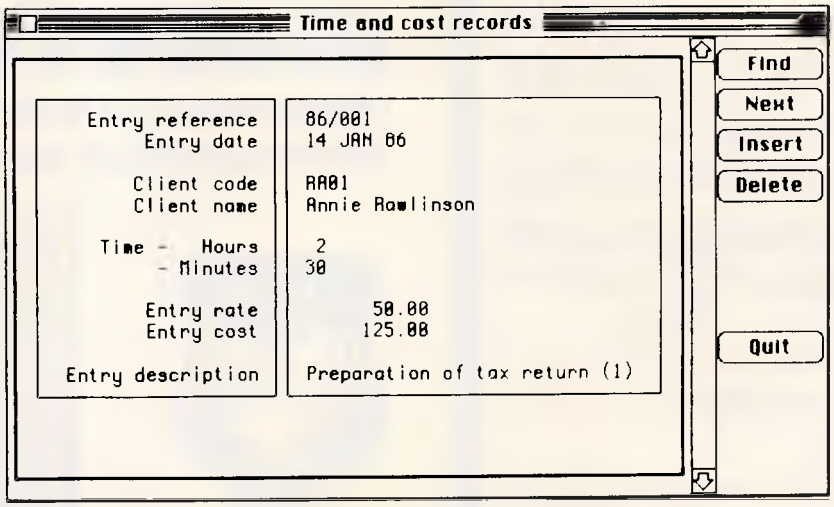
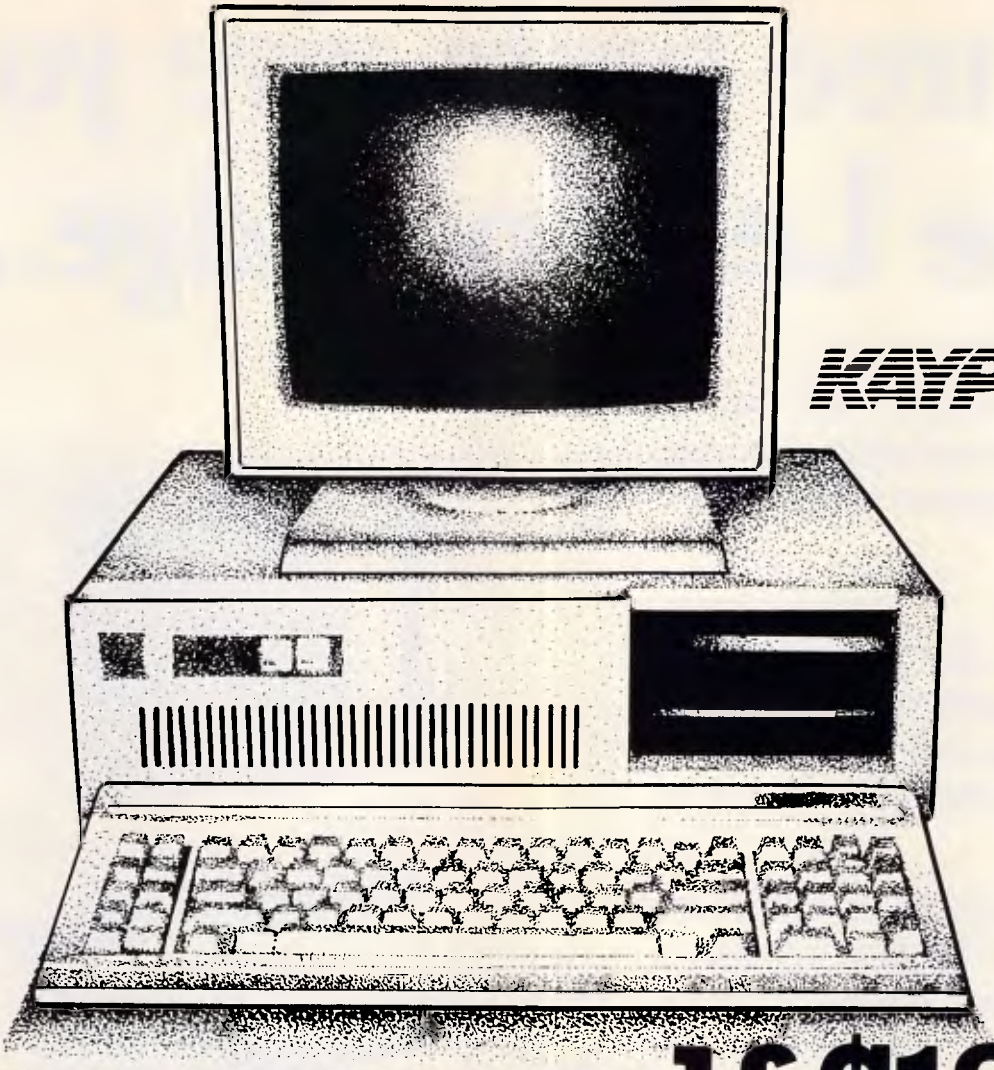


Fig 3 Tailored data entry screen showing subset of main options



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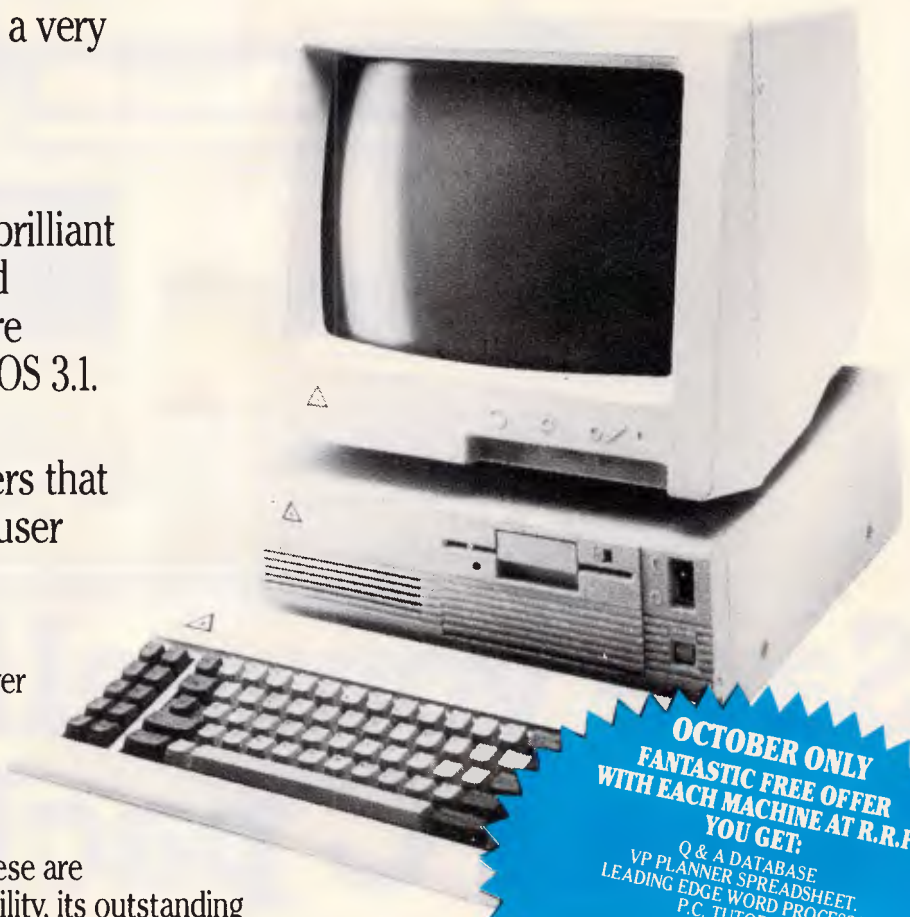

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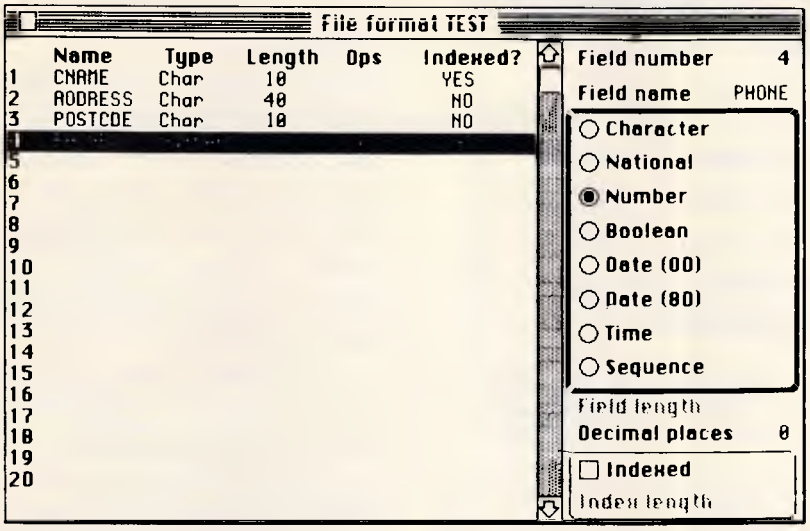

Fig 4 Defining the file format

entry layout is defined; in that case, when editing records, Omnis 3 Plus will automatically put the cursor on that field and retrieve the record matching the value you enter, without having to invoke the menu option explicitly. If you want to edit a record or a group of records using a search on fields that are not indexed, you can use the general selection mechanism to set up a search format and then invoke it from a menu.

Records can also be updated in a batch, by modifying the commands available at data entry to give repeated modification of all or selected records.

Screen display

The entry layouts used to permit data entry can also be used to display individual records. In addition, any report can be sent to the screen as an alternative to the printer, and it is this method that you would use to show *ad hoc* lists of selected records and fields.

Reports

A frequent criticism of earlier versions of Omnis 3 was the awkwardness of the reporting facilities. In the new version, these features have received a major revamp, and reports are now much easier to set up, as well as providing a good range of features.

A report specification defines, mainly using paint-a-screen methods, the layout of a report, which may be up to 240 columns (40 fields) wide by 240 specification lines long (the length of the report itself depends, of course, on the number of records included). The record specification can be repeated across the page, to allow you to set up label formats. The information may be drawn from up to 12 files; where the data file contains abbreviations for common items (such as M for male or DP for Data Processing Department) you can set up a look-up file containing full captions for the abbreviations. The full range of Mac fonts can be used.

If your needs are simple, there are default formats allowing either one record per line or one field per line. These can be used to print reports about all fields in a file, or a range of adjacent fields.

Records can be selected and sorted, with the specifications being included in the report specification, or entered when the report is produced.

Selection & sorting

Direct record retrieval is possible through any indexed field when entering or amending data. To select one or a group of records on other fields, you must set up a search specification first. This allows field comparisons using relational operators (greater than, less than, and so on) and checks for text fields starting with or containing specified characters. Each pair of tests can be combined with AND (both must be satisfied) or OR (either condition must be met), but you cannot use brackets to change the order of evaluation, so you have to be careful to get the tests in the right order. This search specification can be used to select records for amendment or display through entry formats, or for display, printing or storage in a disk file when allied to a report specification.

'Omnis 3 provides a good compromise between ease of use and powerful facilities . . .'

When individual records are retrieved through an index, the 'next' and 'previous' commands allow you to browse through the file in the order of that file. For reports, you can choose to sort on up to nine fields, with sub-totals at each level if you wish; sort order may be ascending or descending, and for text fields may use either the current file values, or upper-case conversions of them (useful where people have been inconsistent about data entry). The precise sort order of text fields also depends on whether they are defined as character (in which case the ASCII sort sequence is used, with, for instance, all capital letters sorted before all lower-

BM1	Time to add one new record	3 secs
BM2	Time to select record by primary key	2 secs
BM3	Time to select record by secondary key	2 secs
BM4	Time to access 20 records from 1000 sequentially on three-character field (same field as in BM2 key)	3 secs/3 secs
BM5	Time to access record using wild-code	3 secs/3 secs
BM6	Time to index 1000 records on three-character field	5 mins+
BM7	Time to sort 1000 records on five-character field	NT
BM8	Time to calculate on one field per record and store result in record	10 mins 20 secs+
BM9	Time to total three fields over 1000 records	4 mins 45 secs+
BM10	Time to add one new field to each of 1000 records	12 mins 45 secs

Time to import a file of 1000 records: 10 mins 35 secs
Notes: NT = Not tested; NP = Not Possible; + = including scrolling, calculated for 200 records
Where two times are given, first is access to first record, second is access to each subsequent record

Fig 5 Benchmark times recorded on a Mac/F

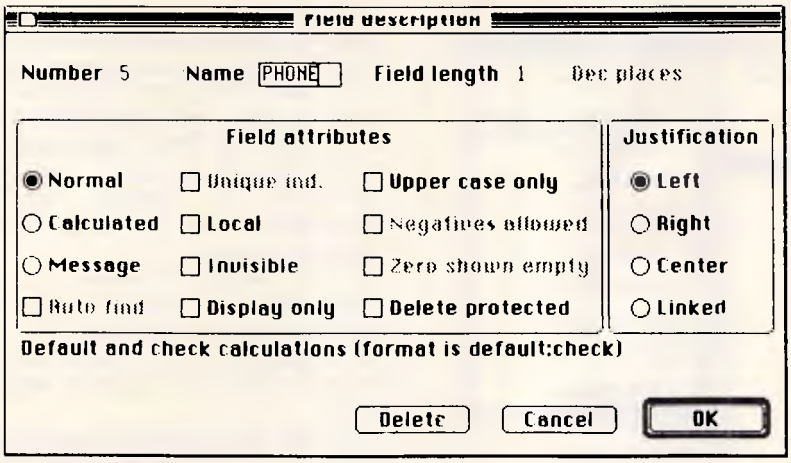

Fig 6 Defining a field in an entry screen

case letters) or national (using the national character set defined in the Macintosh system file, and letters are sorted in order ignoring the distinction between upper and lower case).

Calculations

Fields can be calculated on data entry, or in reports, using field values and constants; a good range of functions is provided in addition to the usual arithmetic operators.

Multiple files

Links are set up between files when the files are created. Direct linkage is possible where the connection is to be one-to-one (a record in the 'parent' file relates to one, and one only, record in the 'child' file) or one-to-many (where one 'parent' record may be linked to one or more 'child' records). Where several records in the 'parent' file may be linked to several records in the 'child' file, you must create a link file, with connections to both parent and child. In that case, though, only two true data files are involved. Omnis 3 Plus needs three files to make the connection, and all three count towards the maximum of 12 files/indexes allowed in one application.

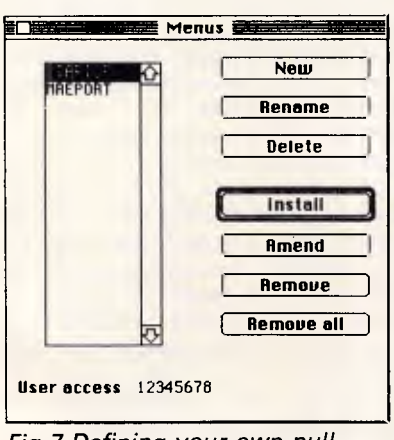

Fig 7 Defining your own pull-down menus

Tailoring

Omnis 3 Plus takes an unusual approach to producing tailored applications. The method is to allow you to modify the basic features of the package; for example, you can restrict users to a subset of the possible options on data entry, and modify permitted options to include facilities specific to the application. Fig 2 shows the default set of options, while Fig 3 shows those for a tailored application.

You can create menus to allow less experienced users to access particular functions direct. Included in the additional statements that you can enter are simple conditional expressions, and the ability to test flags for the result of preceding operations. Memory variables are not supplied directly, but you can use a data file to contain temporary fields, and arrange for them to be read into memory before an entry layout is processed.

Summary

Supplier:	Busiware
Telephone:	(02) 211 1266
Cost:	$949
System:	Macintosh
Version reviewed:	Macintosh
Features:	Up to 12 data files in one application, fixed length records. Powerful data entry and reporting features, tailoring of features to provide simple but powerful application development including user menus. Closely integrated with Mac features.
Drawbacks:	Combined limit of 12 data and index files. Need to store search sequences.
Ease of use:	Good: well-designed menus, use of mouse in designing screens, initial features used as-is or tailored.

Package	*Cost ($)*	*Summary*
MacLion	399	Powerful relational system for Mac, using icons, menus and mouse, and allowing system developers to use them through complex Leo programming language. Simple to use at basic level. Most suited to compact records holding mostly numerical data or dates.
Paradox	1470	Table-based system for IBM PC; many similarities to 1-2-3. Tables can be related. Good querying and reporting, powerful command language. Keeps data in memory if possible: speed on larger tables should be checked. Easy to use at basic, menu-driven level.
Omnis 3 Plus	949	Probably the most powerful data management system for the Mac. Allows development of sophisticated systems using simple methods, well-integrated with Mac approach. Permits 12 data files open, fixed-length records. Powerful screen layout and reporting.

Fig 8 Comparison of similar data management packages

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- Colour Monitor
- Parallel/Joystick Ports x 2
- Lightpen & Audio Port
- Cartridge Port (great for Lotus)
- DOS 2.10/Basic Inc.
- Sampler/Intro Programs

JX 2
- 128K Memory
- 1 x 360K drive
- Remote Infra Red KB
- Colour Monitor
- Parallel/Joystick Ports x 2
- Lightpen & Audio Port
- Cartridge Port (great for Lotus)
- DOS 2.10/Basic Inc.
- Sampler/Intro Programs

JX 3
- 256K Memory
- 2 x 360K drives
- Remote Infra Red KB
- Colour Monitor
- Parallel/Joystick Ports x 2
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Links with outside

Omnis 3 Plus allows the import and export of files in six different formats, from the DIF format used by many spreadsheets, to simple ASCII formats using commas or carriage returns to delimit the records.

User image

Omnis 3 Plus is well integrated into the Mac approach, using the mouse and pull-down menus, and allowing you to modify menus and the operation of user commands. For particularly common functions, such as Insert during data amendment, you can use a key sequence instead of invoking a menu option. Screen and report formats are created by paint-a-screen methods, and the mouse is a big help in this kind of task. The 'temporary array', used when displaying several records from the same file in data entry, I found rather difficult to come to grips with.

Omnis 3 Plus's features are described clearly in the documentation — the tutorial manual, which does a thorough job of teaching about the basic features, and a reference manual. This begins with an account of the overall approach used by Omnis 3 Plus, a welcome but unusual inclusion, and then explains the operation of each feature in detail. The distribution disks include a representative set of examples.

Conclusion

Omnis 3 Plus provides a good compromise between ease of use and powerful facilities: the approach of providing a standard set of features which can be modified as your needs and understanding grow has a lot to recommend it. The Mac lends itself to implementing the approach in a helpful way.

The constraints of the Omnis 3 Plus approach mean that its facilities will fall short of those needed by some system developers, but for others, and still more for ordinary users wanting to build quite sophisticated applications, Omnis 3 Plus is well worth a close look.

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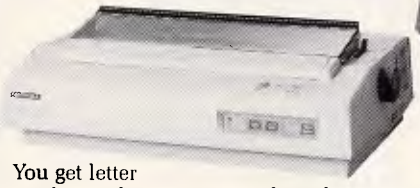

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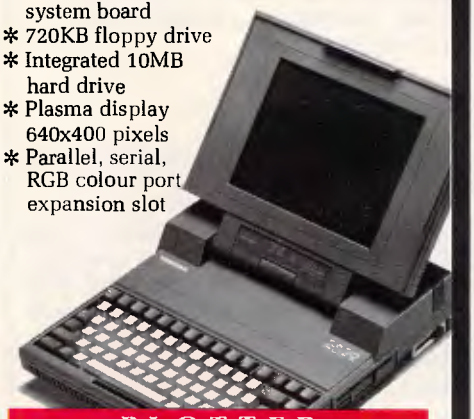

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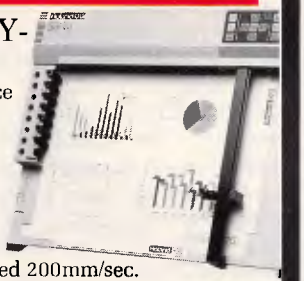

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This is the chance to air your views — mail to 'Letters', Australian Personal Computer, 2nd floor, 215 Clarence Street, Sydney 2000. Please be as brief as possible and add 'not for publication' if your letter is to be kept private.

Cheap alternatives?

Reading the September issue of your magazine, with something like 19 advertisements by Taiwanese companies, one cannot help feeling sorry for the prospective 'bargain' hunter —be it an end user or a small computer dealer thinking that here is an opportunity to buy computers directly from the manufacturer at greatly reduced prices.

Firstly, I would like to set the record straight that a number of companies who advertised are not manufacturers, but in fact nothing more than trading companies. These are companies in Taiwan who set up a small office (literally a hole in the wall), with a telephone and telex, they purchase on the prospective client's behalf from Taiwanese manufacturers, with an obvious price penalty, as they also have to live, meaning a 10-15% increase price for the same product.

As an importer from Taiwan for the past two years I would like to pass on some of my experiences to would-be importers, in order that they may avoid some of the headaches, heartaches and in some instances financial loss. The following is but a small list of the problems encountered when importing from Taiwan:

- On an average two out of 10 units, be it a simple card, or a complete computer, do not work on delivery. We have also had a number of shipments where 10 out of 10 units do not work.
- As the Taiwanese are at present mainly copying hardware originating from the USA with certain small modifications, (sometimes improvements), they also copy (and faithfully photocopy) the original manuals. However whereas they have the expertise in regard to the hardware, they certainly lack it in the area of manuals resulting in:

— totally or partially illegible manuals
— totally or partially unitelligible manuals written in 'jinglish'
— manuals that do not correspond to the hardware at all.

- Although most Taiwanese companies offer from three months to 12 months warranties, how does one go about getting something faulty either repaired or replaced?
- There is a language difficulty, both real and deliberately created, and played upon by not all but most Taiwanese suppliers. So in case of difficulties, it is either totally impossible or at best very expensive to obtain help, and unless one is, or employs a very competent hardware engineer, one could end up with a lot of useless dead stock.
- There is an apparent total lack of after sales support from the supplier, attributable to one of two factors:

— they genuinely cannot help, as they are not computer experts or professionals, their background ranging from accountants to ex-import/export salesmen in anything from textiles to bamboo furniture.
— the Taiwanese business ethic is such that unless the product is actually faulty it is not their responsibility to 'make it work for you'.

I appreciate that this letter is getting rather lengthy, but I feel very strongly about the matter and would like to illustrate some of the points above with some real examples.

I should also point out here that over the past two years we have eliminated, at quite an expense and headache, some of the chaff and we are now dealing with the cream of Taiwanese computer suppliers. We are not 'peanut' business to them, turning over in the vicinity of $100,000 per month, so perhaps we would receive a little more consideration than the guy buying a $50 board:

1. We are employing a hardware engineer (I am also a hardware engineer) to 're-manufacture' almost every unit of every shipment. Our failure rate unlike the two to 10 out of 10 is less than one unit in 200 returned within 12 months, showing that with proper care they can be made reliable.

2. We re-write most instruction sheets/manuals in *English.*

3. Take the instance of a typical Taiwanese failure: the humble power supply unit. These fall over with monotonous regularity, but what are the options? As power supplies weigh in the order of 2.5kg it would cost in the vicinity of $A45 to send it back by air-mail for replacement. The return journey to Australia costs around $A80 by speedpost.

Upon re-entry into Australia you will be charged 30% duty on same, although originally it came in duty free (inside a computer) adding a further $A20 to the cost of replacement, totalling now approx $A145.00. Fortunately this exercise would only take between one and three weeks.

The cost of the original power supply is only $A90, so what does one do when a power supply fails? . . . drop it in the rubbish bin, you cannot repair it, there are no circuit diagrams . . .

4. Please see series of telexes over a period of three weeks *(excluded for space reasons — Ed)* regarding the DIP switch settings for a floppy controller, which we only needed by the way, because our supplier found a cheaper source for the card with a cheaper manual. So cheap indeed, that half of it is missing, including the most important part: how to set up the thing so you can use it.

5. The other type of problem constantly occurring is the changing of design, either hardware or firmware. For example: they change the BIOS on the motherboard; change the BIOS on an EGA compatible card; or change the clock rate of the motherboard without changing the speed of RAM chips (that would cost money). Suddenly your EGA card that worked with almost all clones will now only work with some — maybe 40%; some software that ran beautifully before now just hangs. So you go back to your supplier for help . . . if you are lucky he just won't understand your problem; if unlucky, he will tell you that his machine in Taipei is working very well

and that you are welcome to come over and have a look. So you sort it out yourself, that is, if you are capable of doing so.

I know this is very long-winded and perhaps sounds emotional, but I would like to point out that I am in Taipei every two months for several weeks, and in fact we have now set up our own purchasing and assembly facility in Taipei, which we find is still cheaper than doing business the conventional way.

One final thing I would like to point out is that in a number of cases we sell the same products offered by Taiwanese companies advertising in the last issue of *APC* (in fact they are some of our suppliers) except we offer an improved and debugged version of the same item. For example Soyo is offering a Mini-AT motherboard working at 8MHz; we are selling that same Soyo motherboard working at 10MHz with local support and with 2 years warranty instead of three months.

R Toronyi
Computer Enhancements

Uncalled-for bias

After reading the August edition of *'Australian Personal Computer'* there are several things which I believe I must comment upon.

It appears to me that some of the journalists who write for your magazine are using the magazine to publish their own opinions on various issues without providing balanced and rational discussion. For instance, Guy Kewney's comments on the Strategic Defense Initiative (SDI) are laughable.

Perhaps one reason why the SDI project could fail is the fact that the media is shaping popular opinion with irresponsible comments.

Let's face facts. Guy Kewney's comments were unintellectual, for example:

"This is fantasy."

The questions he raised were rhetorical:

"... surely if the Enemy can get five per cent of his missiles through, all Star Wars does is guarantee that the Enemy is going to build twenty times as many missiles ...?"

He failed to give serious consideration to the problems and benefits the development and installation of the system would bring:

"How many test runs are we going to give Star Wars?

Sorry? Oh, we're going to simulate it, are we? On what? Computers? What kind of computers?"

The only point Guy Kewney managed to make is that software can be hard to debug. However, given enough effort and skill bugs can be removed. I have seen hundreds of programs that don't have bugs as proof of this. Guy Kewney managed to condemn one program while ignoring many others which don't have the fault he was focusing on. Put simply, he is prejudiced.

There are some comments I would like to make concerning *Banks' Statement.* Martin Banks stated:

"Being a great believer in the idea that humanity shows an illogical desire to invent things simply for the sake of inventing them — in the hope that they might one day prove 'useful', like the hydrogen bomb ..."

and he also stated:

"Either we will continue as now and blow ourselves up ..."

I fail to see the relevance of these comments to the preamble of the article, which stated:

"If we are to fully appreciate artificial intelligence, we must learn to see man/machine 'integration' as a logical advancement."

As I fail to see the relevance (in fact, I believe there is none), I can only assume that your magazine is becoming a repository of anti-nuclear (and anti-SDI) propaganda. I do not object to your being against these issues, but it is not satisfactory to propagate ideas and raise questions without intelligent discussion, something Banks and Kewney seem extraordinarily adept at.

Furthermore, Banks states:

"The last thing needed to achieve such a future is a narrow qualification in computer programming."

Banks does not prove that qualifications in computer programming are narrow, nor does he define this term. He also does not prove that psychologists and philosophers are what is needed, he merely states it. To me, it seems that both programmers and psychologists will be needed because it is difficult for any individual to be proficient at both.

It took Banks five paragraphs (in a nineteen paragraph article) to mention the term "artificial intelligence" (He was irrelevant). Three paragraphs later (two of which explained his interest in AI) Banks stated that there might be signs of common ground between computers and humanity. But, he forgot to state any evidence so I don't believe him. Three paragraphs later he completed a discussion of the name "Artificial Intelligence" (This is waffle). After eleven paragraphs he had produced drivel. Banks is saying that "... man/machine 'integration' ..." has something to do with artificial intelligence, but I think it's related to the six million dollar man ("We can rebuild him ..."). Humour aside, his article was abysmal.

It is rather disappointing that I have had to criticize *APC's* journalists. The fact that I have is indicative that some of your articles are poorly researched, superficial and occasionally blasé. The essence of good journalism is research, and the fact that you spelled the word 'Tombouctou' incorrectly (David Taylor spelt it as 'Timbuktu' on page 138) is evidence of your lack of it. Why don't you lift your game?

D Bourke

As APC *is published in an English-speaking country we prefer to use the spelling of the place consistent with the Australian edition of the Collins Dictionary — Ed.*

Prolog preferences

Like Ian Davies' friends (Turbo Prolog review in the July issue) I was too impatient to wait for Turbo Prolog to arrive in Australia and ordered a copy for the Canberra CAE directly from the States. Ian doesn't say what his friends' reactions were, although his was enthusiastic. My own reaction was one of disappointment.

While I fully agree with many of his comments, particularly in regard to the nice interface, I find that Turbo Prolog has some unpleasant features which is rather surprising given the reputation of Borland.

There is no formal international standard for Prolog, but most Prologs nowadays try to conform to the *de facto* standard of the DEC-10 syntax and semantics. (MicroProlog has a different base syntax but has translators from DEC-10 Prolog. Others such as Prolog II and MU Prolog have extended semantics). The major difference between Turbo Prolog and the others is that it is *typed.* This minor (according to Ian) difference makes it incompatible with *all* others. The standard first order predicate logic is *untyped,* and thus so are most Prologs. This means that programs can be taken from Turbo to other Prologs (by deleting type definitions) but not vice versa. This is (firstly) a nuisance; it would take a

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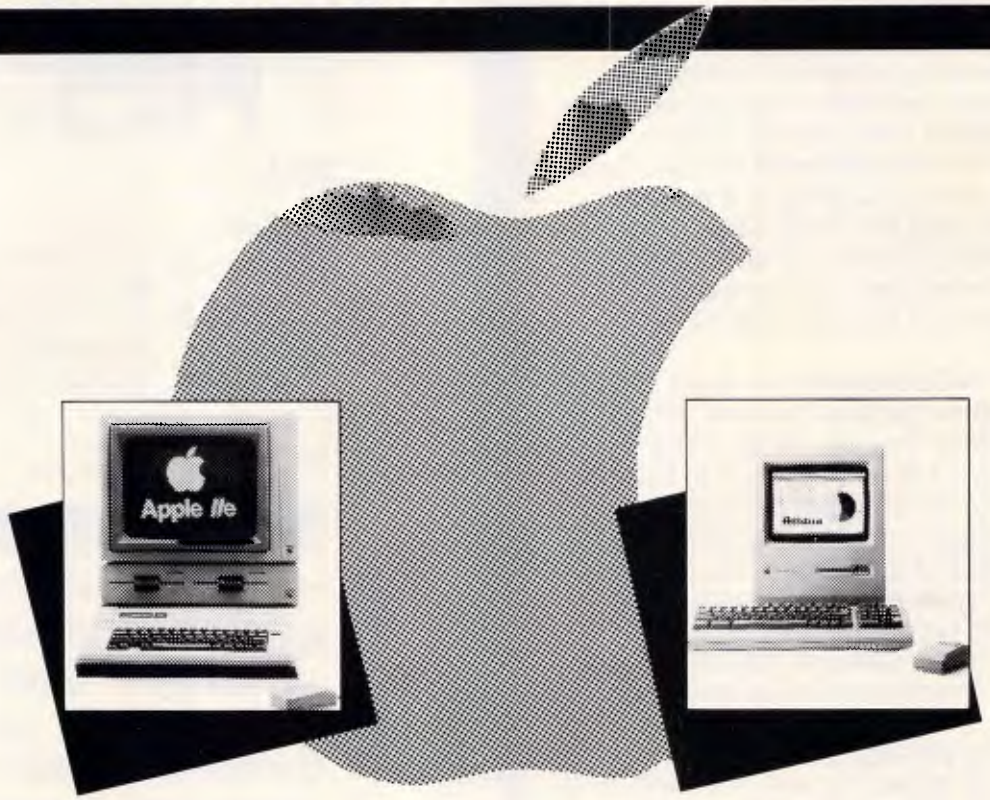

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major effort to track down the types used in all the programs I would have liked to put under Turbo. I could automate this to some extent with a reasonably simple Prolog program, but unfortunately that program would not run under Turbo but only under one of the more standard versions (see next paragraph)! A more serious objection is that half the predicates I regularly use (such as 'member-of-list' which require as arguments 'any-type' and 'list of any-type') will have to be re-typed for each program I write, as Turbo does not supply a type such as 'any-type'. This is silly. As Mishra wrote in his 'Towards a theory of types in Prolog': "a type-system . . . must arise naturally out of the language", and the type theory imposed on Turbo Prolog in fact does not (it inhibits types rather than aids correctness as it should by banning failing constructs). An even more serious problem than either of these is that some constructs which are legal in logic — and hence in all standard Prologs — are not permitted in Turbo. The major one is lists of mixed types which includes lists of mixed integers and symbols. I discovered that I use these quite frequently in trying unsuccessfully to get some things to run on Turbo, and I believe that many other Prolog programmers use them too.

One of the types not included in Turbo is the *clause*. Much has been written about the logic nature of Prolog. What is stressed much less is the 'two-level' nature of Prolog. In any book on logic at least two languages are used: the logic language and the *meta-language* which is the language which can be used to talk about the logic itself. Standard Prolog possesses this meta-language capability which means that it can be used to reason about Prolog programs. When applied to itself, a Prolog program can change its code and thus display some learning ability, if properly done. This ability to treat Prolog programs as though they were data is the property which would, for example, allow a Prolog program to create type information about another program without too much difficulty. Almost all of this ability is missing from Turbo as there is no type 'clause', no 'asserting' of clauses and very little by way of user type checking of variables. These facilities are frequently abused, but Turbo does not do one a favour by banning them totally.

Somewhat related to this is the inability to define new operators for the parser. This is primarily a convenience function which allows one, for example, to write Prolog programs in a more readable way (in exactly the same way as a+b is more readable than +(a,b)). However it can allow one to declare operators which take many atoms as a single argument. Such a characteristic is one which makes it easy to write interpreters, compilers, expert system shells, and Definite Clause Grammars, which are a logic based version of parsing programs. These are all hard (if not impossible) in Turbo.

One benchmark test was not really all that good, especially when that one is not from the area where Prolog shines. I tried two of Warren's benchmarks (he wrote the first Prolog compiler for a DEC-10 computer) on an AT clone and found speeds roughly comparable ie, about 20k LIPS. These tests were not very accurate because bugs in Turbo prevented me from using 'cut' and 'time' adequately for them. Nevertheless, these timings are very good even though they did not support Turbo's claim that it ran faster than the Japanese PSI machine (which really isn't all that fast at 40k LIPS — other researchers are claiming potential sequential speeds of up to 400k LIPS. Even

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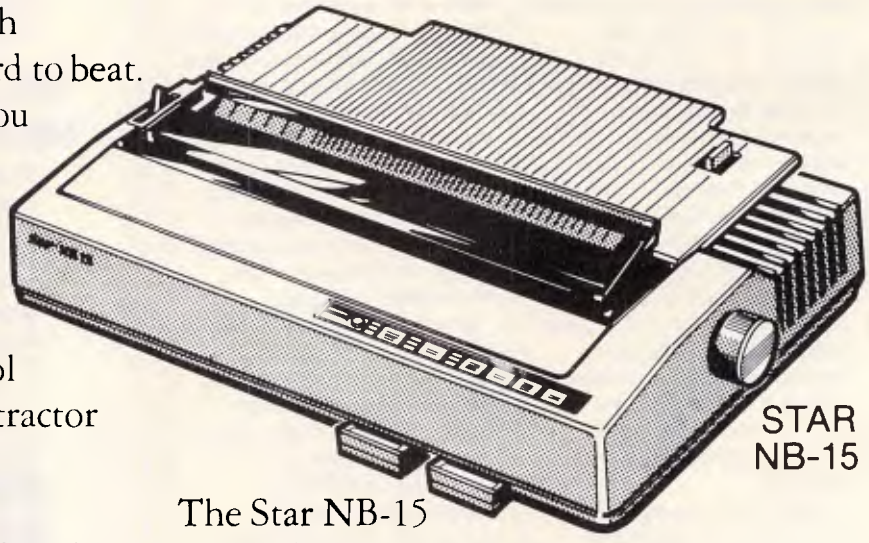

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the Japanese have another machine, the HPM, running at 300k LIPS). I have heard on the grapevine that Turbo speed degrades under different types such as strings. This is admitted in the manual. I have not been able to test Turbo on a large program because I can't get the darned types right and haven't been able to run any of the ones I have. Using Turbo on large data structures seemed okay (much Prolog work is list or tree based).

Would I recommend Turbo? No, I'm afraid not. It's fast. It looks nice. There is a lot you can do with it. But there is so much that you can't do, or that Turbo makes it hard to do, that it starts to lose out badly. I guess the question should be about who it should lose out to! Borland appears to have done this part right again as the nearest price competitors only offer interpreters in this range, with compilers at over eight times the cost. I'm lucky that I have access to one of these. Arity Prolog is my choice for now even at US$800.

J Newmarch

Fair go Phil

Last issue's benchtest on the NEC APC IV by Phil Cohen dealt some heavy blows on the APC III and the crew from the Manly Hospital Chapel Committee have called foul.

Our advertisement failed to attract the expected results due in no small part to Phil's words. He did little to help promote the Chapel Fund's draw for a total computer package built around an APC III.

The fact is that the prize offered comes configured with an SLE board giving full compatibility with IBM software using PC-DOS or MS-DOS.

Complete with Enable version 1.1, an Olympia NP 160 dot matrix printer, two metre printer cable, even a packet of disks and a box of paper. This offer gives great value and odds at $10 a ticket.

Undeterred by Phil's tirade we are proceeding at full steam and wish to place the advertisement in this issue still confident that our package offers a rare opportunity to win such a comprehensive prize.

The drawing date has now been extended till November 29.

Ross McLeod
Manly Hospital
Chapel Fund

Worse than piracy

Thank you for an excellent magazine, I love reading it and find it informative, especially the programming articles — congratulations on the recent AI articles, but how about some 8086 assembly code?

It is, however, a very serious matter which prompts me to write. I am a member of the PC Software Interest Group (PC-SIG) and I am a strong supporter of public domain software. I have just received a letter from Technical Imports Australia proclaiming that for just $A25 they will provide a copy of any individual disk from the PC-SIG library.

For the uninitiated, public domain software is free, it is placed in the public domain by the authors, for whatever idealistic or generous reasons, to be distributed freely. The only charge may be for the media and the copying service, and many programmers put a ceiling limit on what may be charged. Some authors work on the user supported scheme where a nominal donation ($10 to $75) is requested if the user finds the software useful, and a level of support is returned.

I am an avid user of public domain software and claim some of it to be the equal of most expensive software of its type, this is despite hearing such programs as

PC-WRITE and PC TALK III being bad mouthed in reputable computer shops! The PC-SIG maintains a library of 490 disks full of various MS-DOS and PC software covering the full gamut of applications. Any disk is available to members or non-members for $US6, or the entire library on one CD-ROM (500Mb of applications and index information) for $US195. These are very fair prices considering the work involved in maintaining the library, printing professional directories, and keeping members up to date, and a single disk can often be bought in for under $A10 or not more than $A11 if full duty and sales tax is applied.

This brings me back to the $A25 charged by Technical Imports Australia for a copy of a disk from the PC-SIG library. I cannot believe that the cost of one floppy and some copying time can add up to even the $A14 difference in price between what TIA charges and the cost of importing the disk, and I certainly cannot accept the increased profits made from repeated copying of a master disk — $A21 is quite a copying fee, in fact the most expensive I have ever encountered. The most disturbing aspect of this is the *absolutely disgraceful immorality* of someone making money from the work of people who, for ideological reasons, want their work to be freely available. I perceive this as being much worse than the immorality of pirating software, in fact this is piracy, but the role players have changed. I have some software in the public domain, and I would not like TIA or anyone else to sell my software: it is for free distribution only. While this is not the only case of some high 'service' charges for public domain software that I have seen, it is easily the worst and most blatant.

There is now an official PC-SIG outlet in Australia, Manaccom Pty Ltd
PO Box W42
West Pennant Hills
NSW 2120
Tel: (02) 875 3538.

The company is distributing the PC-SIG software for $A11 a disk, which is very good.

I would like to urge all micro users to try some public domain software.

P Doornbusch

Firey 'old girl'

For quite some time now I have been impressed with the way you use your benchmark programs to compare the various machines you review. At first I was also a bit miffed that the machine our company uses in the office was not among those that regularly appeared in the annual round-up. However, after thinking about it, I realised that the machine is usually sold as a dedicated word processor and, because of this, normally does not have any programming languages included (not even Basic).

But there are three other 'operating system packages' available for the machine, one of which includes Basic and Fortran IV and, as it happens, is already installed on ours to be used for development of some new communications software.

So, just for interest's sake, I coded up the eight benchmark programs and ran them on the trusty office word processor. I was apprehensive before running them because I quite like this machine (this letter is being written on it) and I didn't want to find out it was a 'dog'. However, I was pleasantly surprised by the results — so surprised and pleased that I thought I'd write and tell you about them. You never know; some more users of this equipment might be readers of *APC* and they might also be quite pleased to know how their 'old girl' performs.

I'm not sure how you do your timing and arrive at your averages but I used a system where nine readings were taken for each benchmark, the highest and lowest of each set of nine were dropped and the remaining seven averaged to arrive at the benchmark's time. These eight times were then used to calculate the overall average. The results I obtained are shown below:

Benchmarks

BM1	1.87
BM2	1.60
BM3	4.31
BM4	4.63
BM5	4.97
BM6	14.02
BM7	18.52
BM8	22.45
Average	9.05

I compared this result with the Benchmark Roundup published in the February 1986 edition of *APC* and was quite intrigued to find that it put my system eighth on the list, behind the Olivetti M24 and just ahead of the Xerox 16/8.

And the machine itself? The humble DECmate II! Yes folks, 12-bit architecture that's twenty years old. Built into an 'office word processing system' with the CPU running at 8MHz and the I/O processor at 4MHz (don't ask me . . . I only use the thing!) with only 32k (12-bit) words of user memory. It actually has 64k words but apparently half of it is 'control' memory and not available for user programs. The Basic used for the benchmarks is part of the OS/278 package which can be obtained from the Digital Equipment Computer Users' Society.

Apart from Basic, it also contains a full screen editor, a Fortran IV compiler and run-time system, two assemblers (one absolute and one relocatable), some loaders and various file manipulation utilities. In fact, the system is derived from an older one, originally called PS/8 which, with DEC's RT-11, formed the conceptual basis for CP/M.

It is true that the DECmate II is not a fashionable machine, but I think that such a result with your benchmarks should encourage any DECmate II users to re-think the value of their system.

N Goddard

END

'I used to write software until I got replaced by a younger know-all.'

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Note that the public domain disks we distribute differ from most other public domain disks available in Australia in three *very important* ways. Instead of just copying disks from other collections, we've put a lot of work into ensuring that (a) the programs on the disks all work; (b) that the tracks on the disk relate to each other (rather than the grab-bag approach of most public domain collections); and (c) that the software represents incredible value. Most public domain disks available from user groups and other distributors contain a mixture of 'gems and junk'. We've separated the gems from a number of disks, and grouped them together into *Australian Public Domain Library* disks of related material, to ensure you get real value for your money. Of course, not all the programs we distribute come from public domain collections. We've also reached exclusive deals with a number of US and UK software companies to distribute their products to you, at cut prices, rigbt here in Australia.

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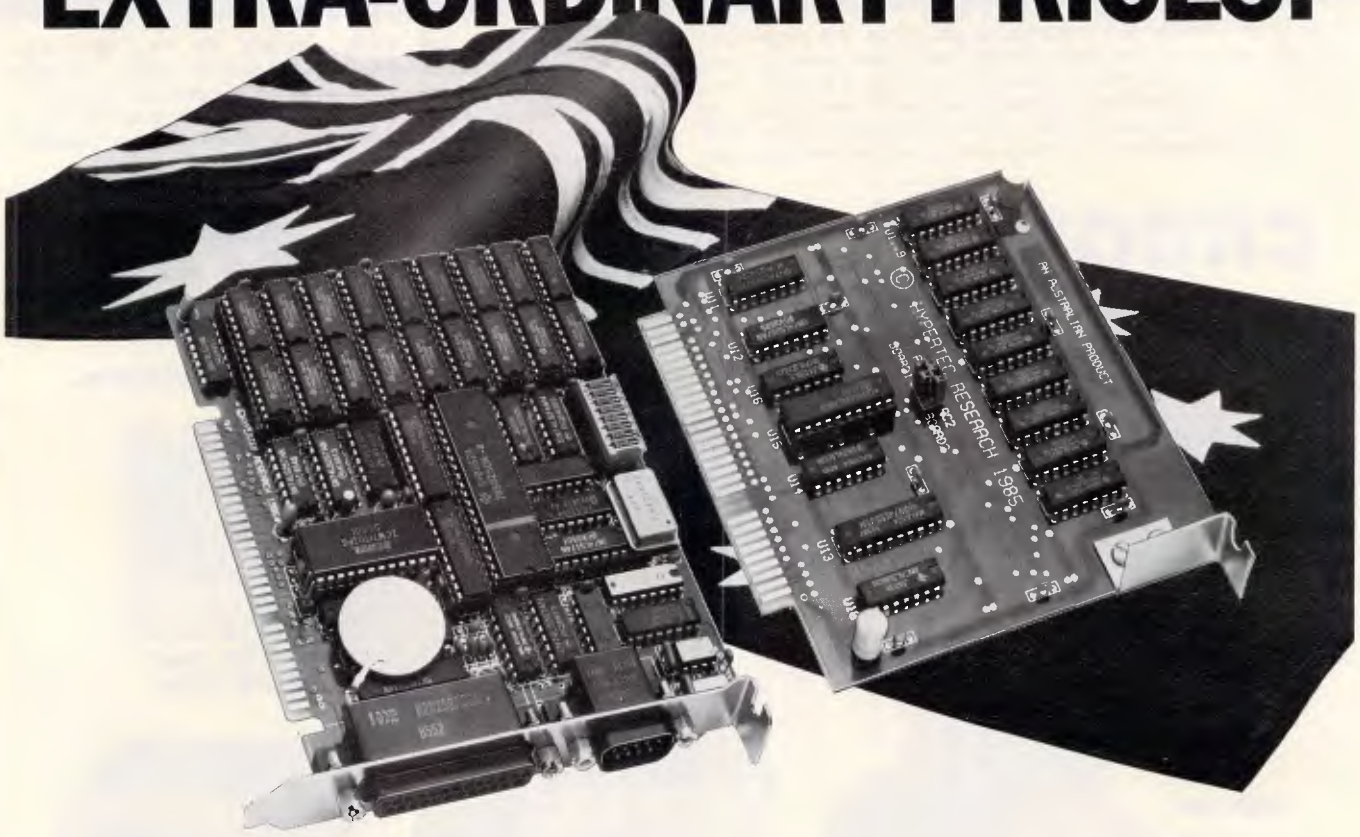

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Atari ST word processors

Word processing is an essential ingredient of a business micro's sales success. Andrew Bennett provides a comparative review of four competitively-priced word processors for the Atari ST series.

One of the very first types of program that becomes available for a new business micro is usually the word processor. The Atari ST series was announced just over 12 months ago and the number of word processors available for it has grown ever since.

In this review I shall be looking at a number of these word processors from the point of view of the ST owner who wants to do serious word processing, and from the point of view of the newcomer who is trying to decide whether the ST is the machine for him. Although the processors reviewed here were tested on a 520ST with operating system in ROM, all of them will work with the 520ST with system still on disk or with the new 1040ST, and their word and page capacity will alter accordingly.

Two speed comparison tests were used to assess performance; the same 23.5k document was used for both. The first test (Move to End) is the time taken to move from the start to the end of the document, and the second test (Search) is the time taken to search through the document for a string that only occurs once at the end.

These timings are important since they give some indication of the overall speed of the word processors under consideration.

The Final Word

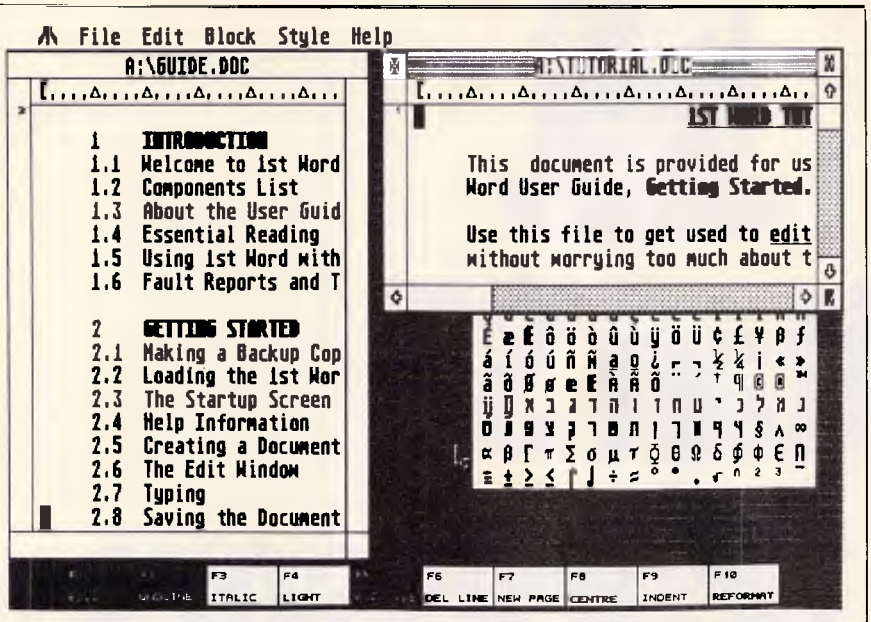
The Final Word arrives in a large library set-style box. The program is supplied on two disks and is supported by two manuals: a 10-section tutorial guide and a reference guide explaining how the program should be set up on the ST.

The program started life on the IBM PC, and this is reflected in the manuals which make no reference to the ST or GEM; the setting-up leaflet is the only part of the documentation that mentions the ST. This tells the user to ignore references to the A> prompt and that the program doesn't use the ST's mouse.

In fact, The Final Word makes no use of GEM whatsoever. The text is displayed in much the same way as STWriter and movement around the document is achieved using the cursor keys and a seemingly endless selection of movement commands. The movement commands include movement by word, a number of words, paragraph and line. Movement can be either forwards or backwards and is always completed in the blink of an eye. When a control key command is issued, it is usually accompanied by a menu which appears at the top of the screen, giving the various choices from that command. The selection is then made by pressing the choice's first letter. Pressing the Help key presents you with a help menu from which you can gain help on almost any aspect of the program.

Formatting and other embedded printer and word processor commands are displayed in the document and, therefore, Final Word cannot be described as a WYSIWYG ('What You See Is What You Get') word processor. Printer commands include the usual bold and other text types, while the word processor commands include some unusual ones not found on the other processors reviewed here. Along with the usual headers and footers, Final Word lets you choose words and phrases which the program will include in the index. Paragraph and chapter headings can also be included in a table of contents. The program also supports footers. The program does all three of these fully automatically, thereby taking the pain out of poducing long documents or books.

Text blocks are chosen by marking both ends in a similar fashion to STWriter. Blocks deleted by mistake can easily be brought back to life with a press of the UNDO key. If you stop typing for a set length of time, Final Word will save what you have just typed or changed to disk. This feature, while sometimes annoying, means that should there be a



1st Word: two documents, function key boxes and character set box

power cut, only the last couple of words from your document will be lost.

Final Word is not for those who simply want to use a word processor for letters and the occasional report, but it will prove invaluable to anyone writing a thesis or a book.

1st Word

When Digital Research could not get GEM Write ready in time for Atari's needs, Atari was forced to look elsewhere for a free word processor to include with the 520ST package. GST was brought in to write a word processor based upon the C source code editor, but with the extra features usually associated with word processing. I include a look at 1st Word version 1.06 here as a comparison against the others. 1st Word has gone through two public versions, 1.01 and 1.06. Version 1.06 is faster and 1.01's bugs have been eradicated.

1st Word is supplied with a 44-page manual, a tutorial guide and printer drivers for the more common printers on one disk. Also included is a document instructing you how to install other printer drivers of your choice. Since it is free, the disk is unprotected and can be backed up as many times as you wish.

Full use of the GEM interface is made, with pull-down menus and the mouse playing a large role in preparing documents. A document is shown in its own window with the usual vertical and horizontal slider bars. Vertical text movement is possible using either the cursor keys or by moving the vertical slider; the horizontal bar allowing documents up to 160 characters wide. Along the bottom of the screen, the various function key definitions are shown in small boxes. These can be used by either pressing the required function key or by clicking the mouse in the appropriate box. Unfortunately the definitions cannot be user defined.

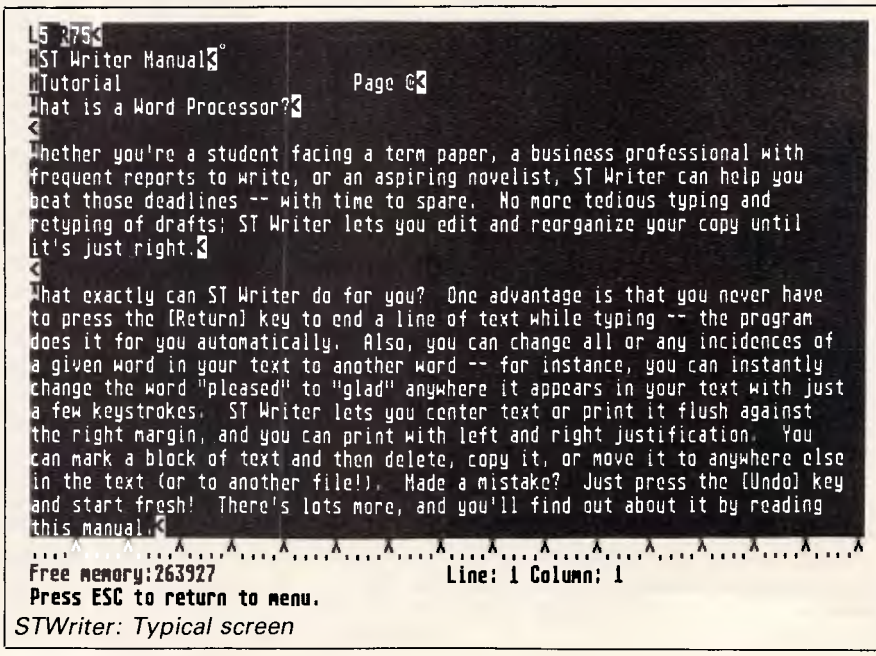
1st Word gives very much a WYSIWYG ('What You See Is What You Get') system. Different text styles, including super and subscripts, are supported and are displayed onscreen as they will appear when printed out. The style can be selected either from the style menu, or by using one of the function keys. The function key boxes also show the current state of the various function key settings. Right and left justification are also supported. Justification is done as the text is entered, but paragraphs must be reformatted each time text in a paragraph is added or deleted. This can be both annoying and time-consuming.

All block operations, such as moving and copying, are achieved by drawing around the block with the mouse. If the block is larger than one screen full then the block start and finish must be marked using options from one of the menus. Block operations in version 1.06 are faster than in version 1.01, but could still do with being faster.

One unique feature of 1st Word is its font table which is displayed behind the text windows. When the user requires a character from the Atari character set which is not on the keyboard, he can select that character from the table. A simple click on the required character inserts it in the document at the cursor position.

1st Word supports up to four different documents on the screen at once with each document occupying its own window. Block operations are allowed between documents, allowing merging of text from several sources into one document. Merge is also available separately, which inserts text from a document held on disk into the current document.

Although 1st Word saves documents in its own format, which includes page settings and embedded control codes, it can also be used to edit ASCII files. This means that it can be used to edit source files for various languages (including Basic) before they are loaded into their respective interpreters or compiled.



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One of the available menus is 'help'. The options on the various menus are listed here. Selecting one of these gives a small dialogue containing enough information to jog the memory or help a first-time user. Extra help can also be selected giving the corresponding help dialogue whenever an option is selected from a menu. Luckily this can be turned off when the user has learnt how to use 1st Word.

One annoying aspect of 1st Word is that it does not have a 'save and continue' option. It assumes that when you save a file, you have finished with it. This means that if, for safety's sake, you save a document, you must then re-load it to continue working.

Overall Atari has probably got a word processor as good as, or better than GEM Write would have been. The only feature that GEM Write might have supported that 1st word doesn't, is the ability to paste in graphics and diagrams.

STWriter

STWriter is a conversion for the ST of the AtariWriter word processor, which is available for the 8-bit Atari computers. It was originally given away free by Atari as a stop-gap before 1st Word was available. The 34-page manual, a simple tutorial, a quick reference guide and a function key template are also provided.

STWriter doesn't use any of the facilities of GEM or the mouse. Text movement is achieved by means of the cursor keys. Scrolling and general text movement are much faster than with any of the other word processors reviewed here. The number of available bytes remaining is displayed along the bottom of the screen with the current line and column number. Strangely the current line number is the line number on the screen, not the line number in the document.

When STWriter is run, a simple menu is displayed which gives the user the opportunity to perform various disk operations including formatting and printing a directory. The most interesting option for Atari 8-bit owners is the ability to transfer files from the older machines to the ST using an Atari 850 interface and an RS232 cable. Unfortunately, STWriter doesn't save files in ASCII format; therefore, files cannot be transferred using STWriter and then edited using another processor or used as source code.

Text style and other formatting codes are displayed in the text as special reversed characters. Various text formatting commands, such as line length, are set up at the beginning of the document, but can be changed in the middle so that special formatting requirements can be met. A print preview is possible where the document is printed to the screen instead of the printer. This shows the document exactly as it will be printed, but without the various text styles which only appear on the printed version.

Commands are issued using the function keys and various control keys. As with 1st Word, it is not possible to redefine the function keys. The Undo key can be used to restore text that has been accidentally deleted; up to 20,000 characters can be rescued in this way.

Simple mail-merging is supported, but the various address and other information must be entered by hand. The STWriter manual states that mail-merge information can come from certain databases, but makes no mention of which ST databases are supported by STWriter.

STWriter and ASCII files can easily be merged with the document in memory. Whenever STWriter loads a file that is not in STWriter format, it converts it into

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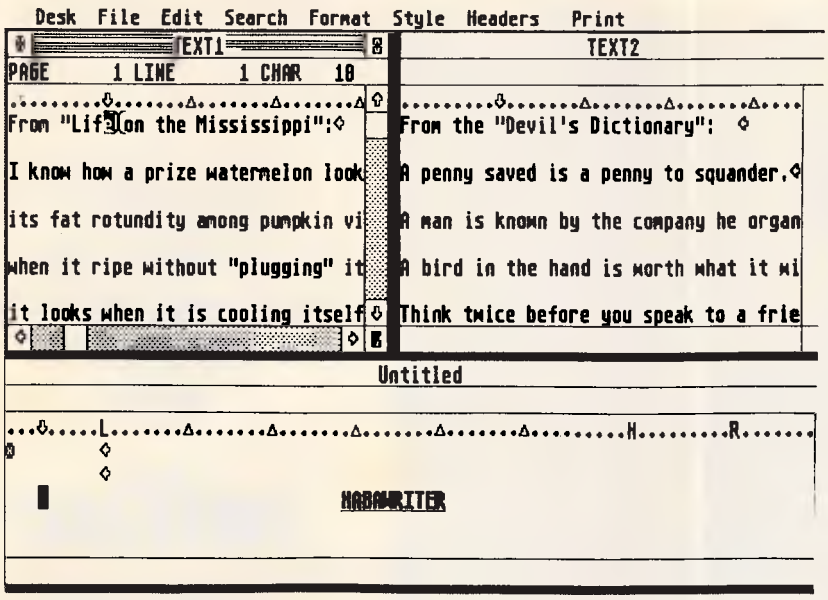

Habawriter: Three documents onscreen

its own format.

Blocks of text are selected by pressing shifted-F5 at the start and end of the block. Another press of F5 then moves the block into a buffer from where it can be pasted back elsewhere into the document.

STWriter is an excellent program which would look good on any other than a WIMP micro. It should appeal to those who don't like mice and windows, but other users will probably prefer 1st Word.

Habawriter

Habawriter from Haba costs $99 and is supplied with a 52-page manual.

In use Habawriter looks very much like 1st Word. At the top of the current window are displayed the current line, page and character numbers, along with a format line which shows the position of the cursor, left and right margins and tab settings. The latest version of Habawriter also provides a word count facility.

As many as six documents can be open at any one time. A new window can either be opened from the file menu or by clicking on a clear space on the screen. Whenever Habawriter needs to take time to do an operation, a large clock face is displayed in the current window. A single hand on this face shows how much longer the operation will take.

Text is formatted as it is entered. Whenever text is added or deleted from a paragraph or the paragraph is reformatted, Habawriter will hyphenate words which are too long to stay on the current line. Habawriter places the hyphen at a position in the word called the hot zone, which is a certain number of characters from the right-hand margin, and is set using one of the menu dialogues. The hyphen can either be placed where Habawriter suggests, or the user can either move the hyphen within the word, or choose for the word to be moved to the next line. The other word processors reviewed here do not offer hyphenation, but move a long word into the next line whenever text is reformatted. Having to continually define hyphenation marks can slow work down considerably.

Block selection is provided with the mouse. A block can be selected either forwards or backwards. Tabs, returns and other formatting symbols can be represented on the screen or can be turned off to achieve a more WYSIWYG appearance.

Whenever a block of text is deleted or copied, it is placed in a clipboard buffer. This buffer can be viewed at any time and holds the block until another block operation. The clipboard can also be saved, allowing deleted text to be reinserted even after the system has been rebooted.

Habawriter is supplied with an Epson printer driver which must be edited to provide other drivers. Habawriter can print whole documents or just selected pages.

When Habawriter first became available, it was the first ST word processor to use GEM; now, however, there are several such programs. Habawriter offers very little over the free 1st Word.

Conclusion

1st Word and Habawriter are both excellent programs that are easy to use, and use the mouse to the full. Unfortunately, Atari has pulled the rug from under Haba by giving the excellent 1st Word away with the ST. For those of you who don't like windows, desktops and mice, there is the fast and straightforward STWriter.

The Final Word might not use the mouse or GEM, but it is by far the most powerful of the programs looked at here. It is, however, much more difficult to get to grips with, but its power will reward the serious user who perseveres. END

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WHEN RELIABILITY IS THE DECISIVE FACTOR

Means to an end

David Levy's AI series continues with an explanation of how computers solve problems and make decisions, with particular reference to heuristics.

A problem exists whenever someone does not know how to achieve a particular outcome or state of affairs. The problem-solver will have some information about the problem, even if it's no more than knowing the nature of the problem, and during the problem-solving process, the solver repeatedly uses some or all of the available information to discover more information, and more, and more until a solution is reached.

There are many kinds of information which can help to solve problems. There may be information which guides the solver towards the method or approach which should be tried first; there may be information which enables the solver to eliminate completely some of the possible solutions; or there may be information which indicates that the solver should concentrate more efforts along certain avenues. Such information, or rules of thumb, are called 'heuristics'.

People use heuristics all the time in decision-making and problem-solving, often without realising that they are doing so. If you see a grey sky before you leave home in the morning, you will probably take your raincoat or umbrella because you know that if the sky is grey, then probably it will rain. Computer programs also employ heuristics to make decisions and to solve problems.

One of the earliest heuristic-based problem-solving programs was GPS (General Problem Solving) developed by Newell, Shaw and Simon in the late 1950s. GPS would work towards a solution by reducing the goal to a set of sub-goals, in such a way that if all the sub-goals were achieved, then the original goal would also be achieved. If a particular sub-goal proved too difficult, it was split into sub-sub-goals, and so on.

In order to achieve each of the goals or sub-goals, GPS would employ various heuristics in one or both of two different ways: (i) means-end analysis; and (ii) planning. Let's first see how means-end analysis works.

Means-end analysis

If a situation exists which is not the desired one (the goal), it will be possible to detect differences between the two. For example, if I am in Sydney and wish to be in Melbourne, then I know that the principal difference between my current situation and my goal is one of *distance*.

Knowing that *distance* is what separates my current situation from my goal leads me to ask the question: 'What can change this distance?', and I might come up with answers such as: a car, a train, a plane, a bicycle, and so on. The means (the method of transport) has actually been suggested by the end (the reduction or elimination of distance between myself and Melbourne). In order to achieve this type of suggestion, the computer program needs to know what type of operation can bring about changes in a particular aspect of the problem. In this case the particular aspect of the problem is distance, and the type of operation that can bring about a change of distance is the use of a mode of transport.

The problem of distance could be more complicated. I might be at home in Sydney and want to be in the Young & Jackson Hotel in Melbourne. One of the modes of transport suggested by means-end analysis is 'plane', but there are no regular flights from north-shore Sydney to the centre of Melbourne, so I need to get to Kingsford-Smith airport to catch the plane in Sydney and then I need to get from Melbourne airport to the centre of Melbourne. My original goal has now been split into three sub-goals: (1) get from home to Kingsford-Smith airport; (2) get from Kingsford-Smith to Melbourne airport; and (3) get

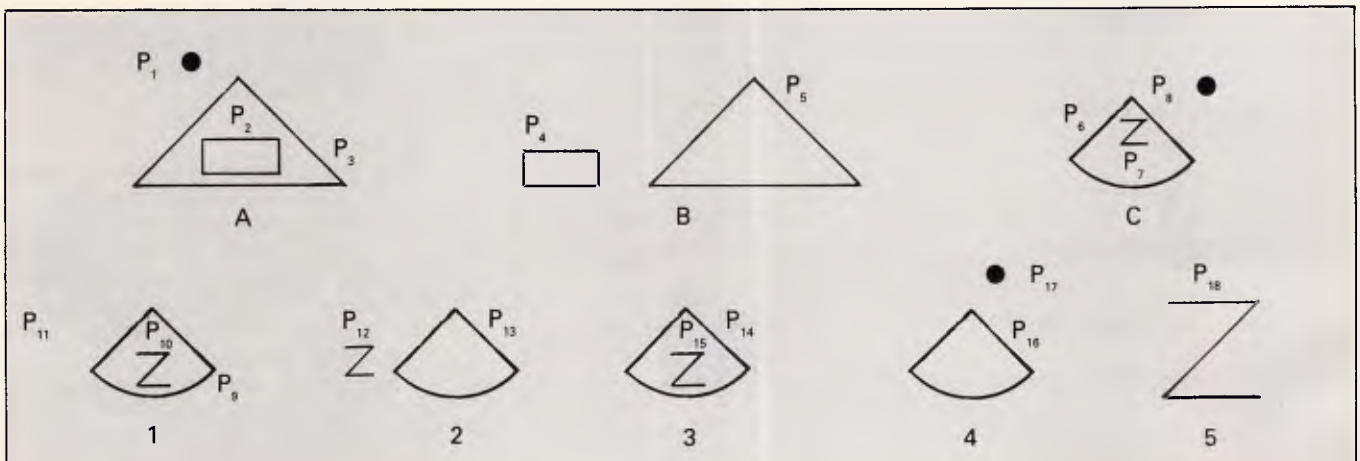

Fig 1 A geometric-analogy problem

from Melbourne airport to the Young & Jackson Hotel. The first sub-goal might suggest taxi, car or bus. The second sub-goal has already been solved (since the sub-goal of getting from Kingsford-Smith to Melbourne airport was prompted by the idea of travelling by plane). The third sub-goal might suggest taxi, car or bus. We can now see that the suggestion of travelling from Sydney to Melbourne by plane has given rise to 12 possible solutions:
(1) Taxi to Kingsford-Smith, then plane, then taxi to the hotel;
(2) Taxi to Kingsford-Smith, then plane, then bus to the hotel;
(3) Taxi to Kingsford-Smith, then plane, then car to the hotel,
and so on. The program might be satisfied to find any solution (in which case it would be delighted to have 12 to choose from); or it might want to find an optimal or near-optimal solution, in which case it would evaluate each of these 12 possibilities with some kind of scoring function before deciding which one to adopt, perhaps based on time and/or cost.

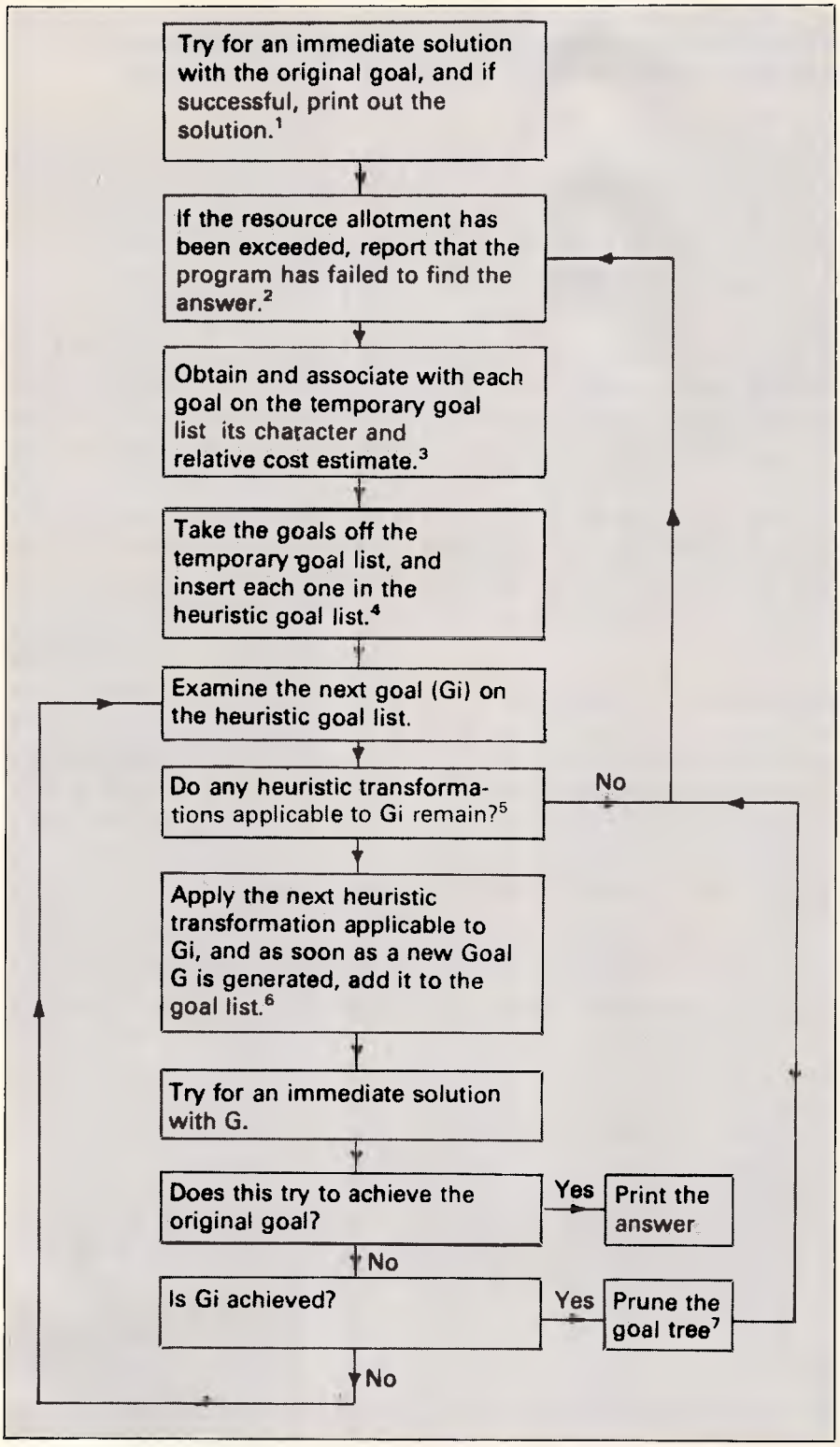

Fig 2 The program flow of SAINT

The approach of trying to reduce the difference between the problem situation and the goal is one of the methods that can be applied in means-end analysis. An alternative method is to transform the problem situation into a different problem, in the hope that the new problem might be easier to solve than the original one.

Planning

The method of planning used by GPS was designed to construct a possible solution in general terms, prior to working out the details. The planning method works by first omitting some of the details of the original problem. This leads to a simpler problem, and when the simpler problem has been solved, the program can use the solution to the simpler problem as its model for finding a plan that solves the original problem.

This whole process is very much akin to the splitting up of goals into sub-goals, but with the important difference that here, there is no *guarantee* that a solution to the simplified problem will lead to a solution to the more complex problem. In contrast, the 'goal into sub-goals' approach does guarantee that achieving the sub-goals means achieving the original goal.

Geometric-analogy problems

In the early 1960s, Thomas Evans wrote a program called Analogy to solve problems of the form:
Shape A is to shape B as shape C is to shape ?
where the solver is offered a multiple choice of solution shapes. Problems of this type are often found in intelligence tests, so it's easy to argue that a computer program which achieves a high degree of speed and accuracy in such tests must clearly be intelligent. Fig 1 shows an example.

The first step taken by Analogy was to decompose each of the problem figures into sub-figures, so that (for example) figure A would be decomposed into a dot, a rectangle and a triangle.

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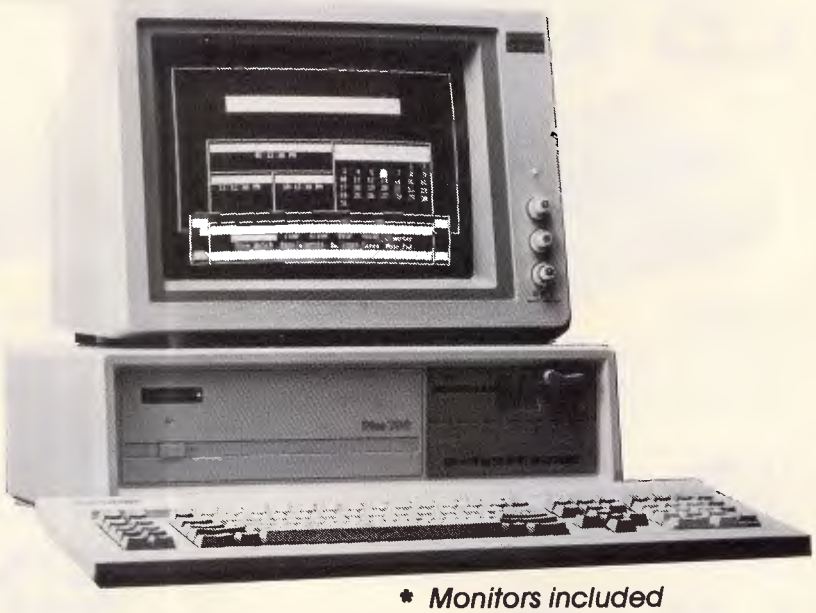

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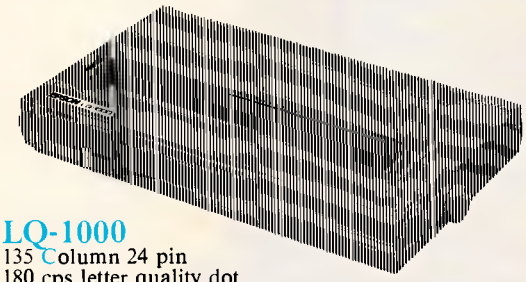

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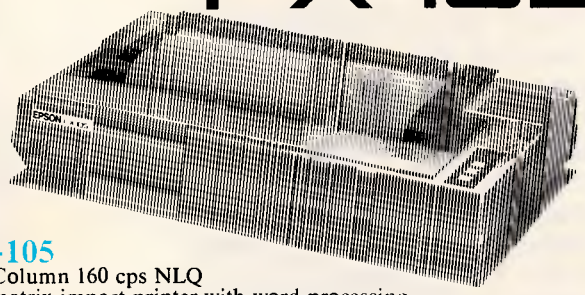

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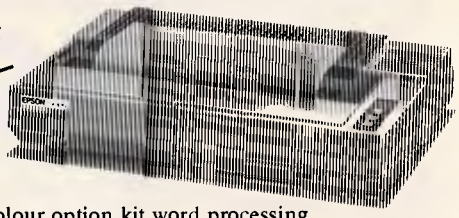

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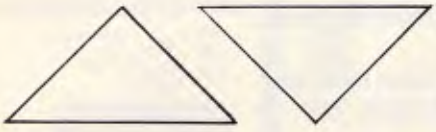
the decomposition would be given to a routine which determined a specified set of properties of these sub-figures and the relationships between them. For example, one relationship in figure A might be that the rectangle lies inside the triangle, and this could be represented by an expression such as [rectangle INSIDE triangle].

The program now examines each appropriate pair of objects and determines what transformations exist that would convert one of the objects within the pair into the other one. For example, if a pair of objects consisted of



the transformation 'turn upside down' would convert the triangle on the left to the triangle on the right. This part of the program is, in fact, a pattern recognition routine which is able to determine the similarity between objects. When the similarity information has been computed for every appropriate pair of objects, both within a problem figure and between different figures, this information, together with the decomposition and relational information, is used to calculate the solution to the problem. We can see how the program 'thinks' by following part of its solution process on the above problem:

(1) Figure A is decomposed into three parts, called P1, P2 and P3.
(2) P2 is inside P3; P1 is above P2; P1 is above P3.
(3) Figure B is decomposed into two parts, called P4 and P5.
(4) P4 is to the left of P5.
(5) Figure C is decomposed into three parts, called P6, P7 and P8.
(6) P7 is inside P6; P8 is above P6; P8 is above P7.
(7) P2 and P4 are the same shape and size and are orientated in the same way; P3 and P5 are the same shape and size and are orientated in the same way.

And so on.

The solving routine now matches the decomposed parts of figure A and figure B in all possible ways that are compatible with the similarity information, and it concludes that P2 is the same as P4, P3 is the same as P5, and P1 (the dot) is removed when going from figure A to figure B. On the basis of this matching, the program generates a statement which shows how figure A is transformed into figure B, such as:
REMOVE P1, TAKE P2 out of P3, MOVE P2 to the left of P3

The next stage is to match figure C with each of the five possible answers (figures 1, 2, 3, 4 and 5). Matchings are immediately rejected if they do not correspond to the ones between figures A and B on the basis of parts added, removed and matched. (In this example, figures 1 and 5 are rejected, while figures 2, 3 and 4 are examined further). The program then tests each of the remaining candidate solutions as follows.

Each step in the transformation

Notes on Fig 2

(1) The program's goal is to perform the integration of the original expression. Whenever a new goal is generated, the program tries to achieve it at once using straightforward methods, and if it is successful, it then tries to achieve the original goal.
(2) The 'resource allotment' is the amount of workspace available. The program keeps track of how much memory it has at its disposal for further attempts at solution, and if memory is exhausted before a solution is found, SAINT reports that it cannot solve the problem.
(3) Any new goal which is not a 'standard form' and not amenable to an 'algorithm-like transformation' is added to a temporary goal list. If the integrand of a newly generated goal is of a 'standard form', that goal can immediately be achieved by substitution. For example, one of the 26 standard forms used by SAINT is:

$$c^v\ dv = c^v / \ln c$$

and so if $2^x\ dx$ were to appear as a new goal on the list, this goal would be achieved by substituting 2 for c and x for v, leading to the solution of $2^x / \ln 2$ for this particular goal. If an integrand is not of a standard form, it is tested to see whether it can be transformed into a goal which is more easily achievable.
(4) The heuristic goal list is a list of goals which require heuristic transformations, and is sorted in order of increasing effort requirement. When a goal is taken off the temporary goal list the program obtains its 'character', which is an ordered list of features of characteristics. These features might be useful in measuring or estimating the cost of attempting to achieve this particular goal.

SAINT employs 11 features, including the function type (algebraic function, function of sines and cosines, and so on), and the 'depth' of the function. The depth of an integrand is the maximum level of function composition which occurs in the expression, for example:

x is of depth 0
x^2 is of depth 1
e^1x^2 is of depth 2
xe^{x^2} is of depth 3

This gives a crude measure of the difficulty of the problem and allows goals to be added to the heuristic goal list according to their relative cost estimate (cheapest first). If no goals remain on the heuristic goal list, report that the program has failed to find the answer.
(5) A transformation of a goal is called heuristic if it isn't certain whether or not it's an appropriate next step. SAINT employed 10 types of plausible transformations.
(6) The original goal is made the first member of the goal list, and then new goals or sub-goals are added from time to time.
(7) There are two types of relationships between goals that affect the significance of the goals. It may be the case that two or more goals *all* need to be achieved in order to achieve some higher goal — this is an 'AND' relationship. Or it may be sufficient to achieve *any one* of a set of goals — this is an OR relationship. From these two basic relationships it's possible to build up more complex relationships, for example: the problem is solved if goal 1 AND (goal 2 or goal 3) are achieved. Whenever a goal has been achieved, the program removes certain closely related goals from the lists. These are goals which have also been achieved as a direct result of this new achievement, or they are goals which no longer need to be achieved (OR goals).

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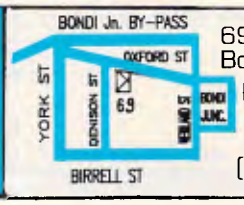

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process that converts figure A into figure B is applied to figure C, if appropriate, and the result is matched with the candidate solution. The purpose here is to find a step, or steps, which convert figure A into figure B and which also convert figure C into one, and only one, of figures 2, 3 and 4. In this particular example, all three steps are applicable to just one of the three remaining candidate solutions. If we remove P8 (the dot), we are left with the sector and the Z, which is true of both figure 2 and figure 3, but not figure 4. If we then take the Z out of the sector, we are still left with the sector and the Z, but they are related in a way which eliminates figure 3. The one remaining candidate solution is figure 2, and this possibility still remains after we carry out the third step of the convert process: move the Z to the left of the sector. The program now knows that figure 2 is the solution.

Symbolic integration

One of the most famous problem-solving programs of the 1960s was SAINT (**S**ymbolic **A**utomatic **INT**egrator), written by James Slagle at the MIT (Massachusetts Institute of Technology). Despite being blind, Slagle has long been one of the world's leading experts in the field of heuristic programming and tree-searching, and, incidentally, is quite a strong chess player. His program was able to solve symbolic integration problems at the level of a good university student: running on an IBM 700 some 25 years ago, it took an average of two minutes to solve 52 out of the 54 problems in the MIT calculus examination for first-year students. SAINT illustrates some of the concepts in problem-solving that have been mentioned earlier in this article, and I would strongly recommend the more serious reader to study Slagle's own paper (see 'Bibliography').

The program flow of SAINT is explained in Fig 2.

Problem-solving trees

The simplest way to represent any problem-solving process in a computer program is with a tree structure (such as that shown in Fig 3).

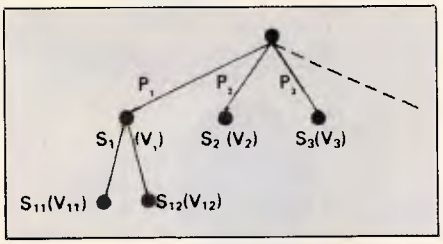

Fig 3 A simple problem-solving tree

The root of this tree (the node at the top) represents the problem. The branches (P1, P2, P3 . . .) which stem from this problem represent the various possibilities that the program can explore from the initial problem situation. The nodes at the ends of these branches (S1, S2, S3, . . .) represent the situations that arise when these various possibilities are tried. Each of these situations has a value (V1, V2, V3, . . .), assigned by an evaluation function, which represents how near or far is the solution from the goal (the solution to the problem).

'People use heuristics all the time in decision-making and problem-solving, often without realising that they are doing so.'

When the program starts out in its search for a solution to the problem, there are various aims that it may have in mind. The simplest aim is to find a solution to the problem — any solution. Or the program may wish to find the shortest solution — the one involving the smallest number of steps or actions. Or the aim may be to find the 'cheapest' solution or to find a solution as quickly as possible. By using a tree structure and by making some simple assumptions, any one of these aims may be satisfied (provided that a solution does exist).

In order to find a solution as quickly as possible, the program explores the tree by repeatedly examining the most likely-looking possibility. It starts by generating all the possibilities from the root of the tree, and then evaluating the resulting situations. It then chooses the situation with the best value (let's assume that this is situation S1, with value V1), and generates all the possibilities from that situation (which we denote by S11, S12, S13. . . .), evaluating the resulting situations (the values are denoted by V11, V12, V13, . . .).

The next stage is to choose the unexplored situation on the tree which has the best value — this might be one of the newly generated situations (S11, S12, . . .) or it might be a situation which was already on the tree (S1, S3, . . .). The program then explores all the possibilities from this new 'best' node, and so on. The process terminates when a newly created situation is found to have a value which indicates a solution to the original problem.

A simple example of this method can be seen in my attempts to get from my home to the centre of Melbourne. The root of the tree would be 'at home'. The first possibilities that I explore might be: go to North Sydney station, go to Wynyard station, go to Central station,

go to Kingsford-Smith airport, and so on. The situations that arise after taking each of these steps would be: at North Sydney, at Wynyard, at Central, and so on, and my program would then need to evaluate each of these new situations. It would hopefully give the best scores to being at Central and Kingsford-Smith, since these places are connected directly to Melbourne by rail or air; whereas being at North Sydney or Wynyard would get worse values, since there are no direct connections to Melbourne from any of these places.

The program would now consider my possibilities from (say) Central, and would discover that one of them (taking a train to Melbourne) has a better value than all the others. The new 'best' node would represent the situation 'being at Spencer Street station in Melbourne', and the program would then explore such possibilities as: walk towards the Young & Jackson hotel, take a bus in the direction of the Young & Jackson hotel, take a taxi to the Young & Jackson hotel, as well as a number of other less useful options (such as take a train back to Central!). As soon as the program discovered, by evaluating its new situation, that I had arrived at the hotel, it would know that it had found a solution to the original problem.

This method works well when the aim is to find a solution relatively quickly, but it's often the case that one wishes to find the best solution. (The word 'best' can mean cheapest or quickest, or it can satisfy some other criteria).

If the program is required to find the shortest solution — that is, the one with the fewest steps, it will evaluate situations in such a way as to provide, instead of a merit value, an estimate of how many more steps from this particular situation will be required before a solution is found. The program can then determine which situation should be explored next, on the basis of the values:

number of steps so far + estimated number of future steps

This method is more likely to provide an efficient solution to the problem, but it can be improved upon still further. The steps in the solution process may not all have the same cost associated with them. My journey to the Young & Jackson Hotel in Melbourne can be split into three steps: travel to an airport or railway station in Sydney; travel to an airport or station in Melbourne; and travel from the airport or station in Melbourne to the hotel. Associated with each of the possibilities at each step there may be a different cost, either in terms of money, or time, or some other commodity. In order to minimise the total cost of the solution, the program modifies its strategy so that it always explores the situation for which (cost of getting to this situation + estimated cost of finding a solution from this situation) is a minimum. The cost of getting to a situation should already be known when the program creates that situation on its tree, and the estimated cost of reaching a solution from that point can be provided by the evaluation function.

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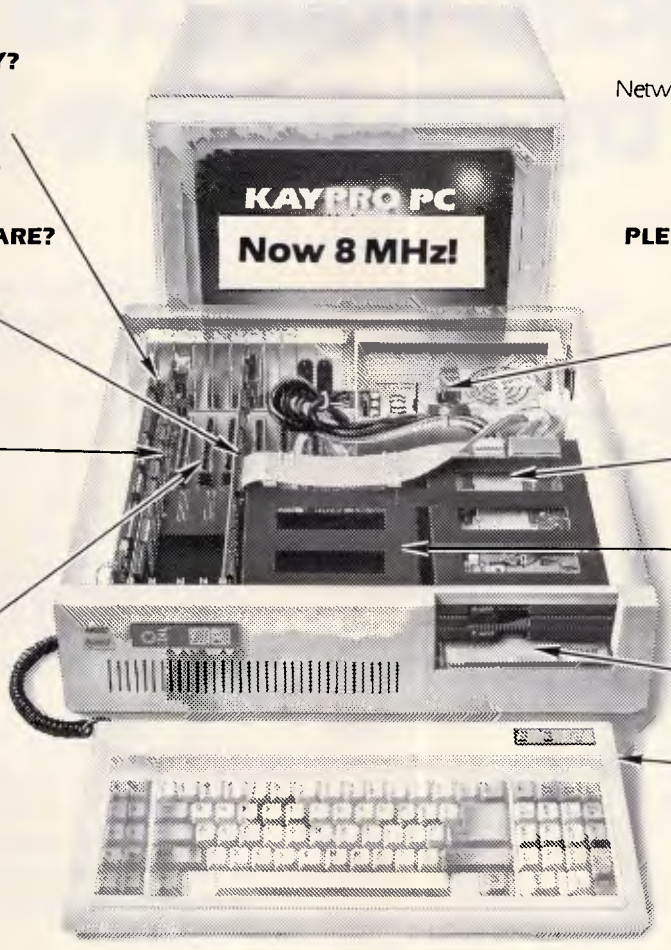

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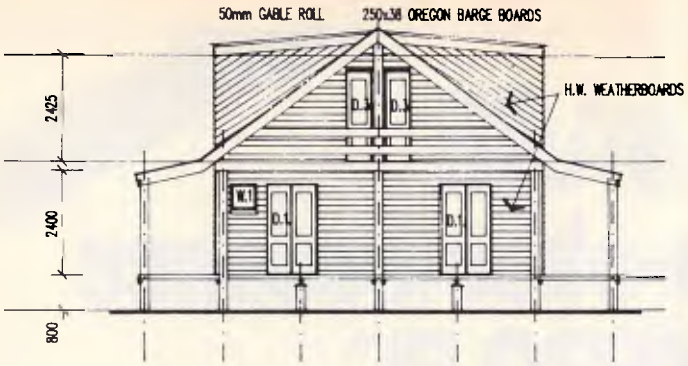

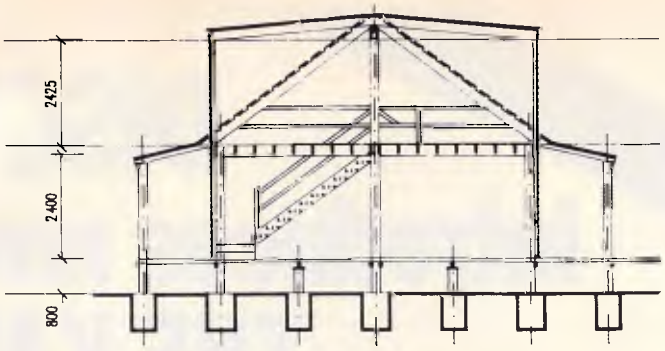

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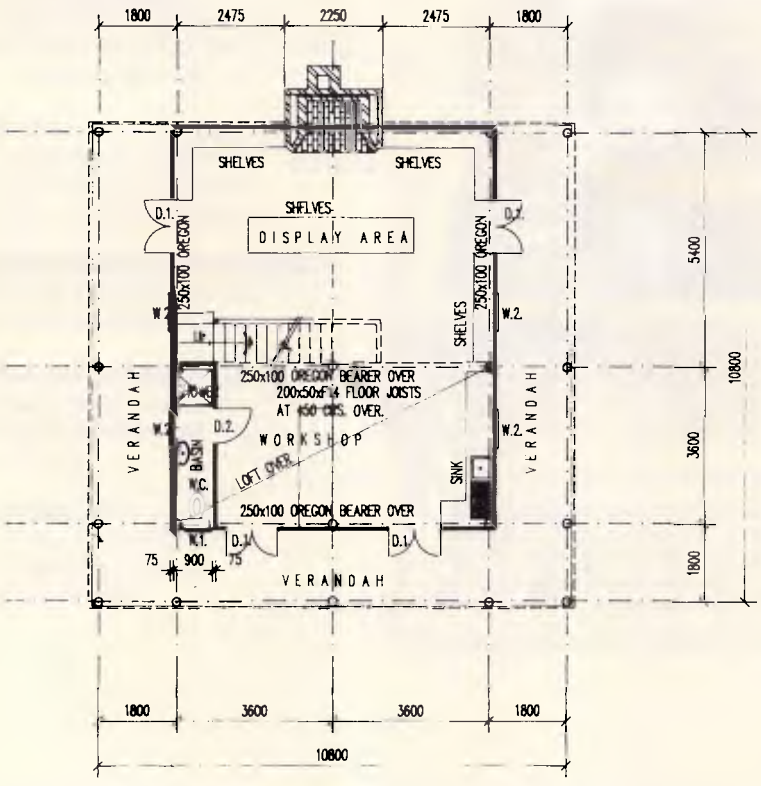

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NSW: CLD Computer Drafting Services (02) 831 1865
VIC: ASSCO Pty Ltd (03) 873 1248
QLD: Kaye & Associates (08) 839 6333
W.A.: PRO-LINK (09) 367 5588
TAS: AutoPLOT (002) 31 0494

Painting the software scene

The range of PC CAD and graphics software is immense. Judith Massey examines a cross-section in our final look at graphics.

Along with word processing and accounting packages, graphics and CAD (Computer Aided Design) software continues to get easier to use and more powerful. If you have a PC you can now try your hand at being a da Vinci or Brunel.

There are hundreds of packages to choose from. They cover simple business graphics and drawing needs, general architectural or engineering drafting, and specialist applications like PCB (printed circuit board) design.

If you have a stand-alone PC you can present results in an attractive and easily understood format. Graphic designers and architects may find tedious drafting easier with a 2D drawing package. And a survey in *Industrial Computing* last year found that manufacturing companies bought 50 per cent more graphics software than the year before.

That last group, together with corporate business users, takes advantage of packages that let you download graphic images or spreadsheet files from a mainframe. It's often easier to manipulate data and images on a PC than on bigger machines.

Higher quality printers, faster processors, cheaper high-resolution screens and easy to use software are all good reasons to start using a graphics package.

There are two types of low to medium-range packages. The first group lets you display spreadsheet or statistical data as graphs, then prints it out as overhead transparencies, slides or hard copy.

Even the simplest business graphics package can make a vast difference to a presentation. Showing your clients or colleagues rows of sales figures or profit percentages is more likely to confuse than illuminate. But a coloured bar or pie chart helps get your message across.

The best packages, like Microsoft's Chart and Digital Research's GEM Graph, are easy to use and flexible. Chart follows the usual pattern of Microsoft programs, with a similar menu line. You can import 1-2-3, Multiplan and dBase III files among others.

GEM Graph works with data from popular spreadsheets too. But it also runs in conjunction with Digital Research's other GEM programs like GEM Draw and GEM Write. This means you can combine text, drawings and

The computer products with enough integrity to build out obsolescence!

The Intelligent Modem™ operates with rotary dial, Touch Tone® and most PABX systems. Its helpful screen messages guide you through the progress of the connection and tell you when to begin communicating or if you have reached a wrong number.

Either choice is the right choice.
If you are new to telecomputing you may wish to begin with our low cost Intelligent Modem (model T-013). It features a selection of speeds from 300bps to 1200/75bps and is the modem of choice for personal computer owners.

If you will be transmitting over long distances and handling larger volumes of information then the Tulpi (model T-123) is the one for you. It provides reliable, quick and economical transmission of data to remote systems at rates up to 1200bps. (The model T-013) can be upgraded to this model at a later time).

TeleCorp's support is the best in the business.
Tulpi Intelligent Modems are covered by our unique **Five Year Non-Obsolescence Guarantee,** which states that TeleCorp will assure the Tulpi you purchase today will be upgradable to stay in the mainstream of personal telecomputing for the next five years or *your money back.*

All Tulpi modems are backed by a limited one-year parts and labour warranty.

In addition, our customer support representatives are always happy to speak with you when you need a little help too.

So make the intelligent choice when you purchase yur next modem. Ask for a TULPI Intelligent Modem™ by name.

TULPI Intelligent Modem Features:
● Connects directly to line — either dial-up or leased. No handset required. ● Auto-dial and auto-answer for completely unattended operation. ● Touch Tone® and pulse dialling. ● TULPI™ commands for executing automatic dialling and answering are built-in — no auxiliary device is required. ● Built-in Hayes® compatible 'AT' commands operation. ● User selectable constant speed interface to the DTE up to 19,200bps. ● Four channel I/O controller. ● Data speed conversion. ● RS-232 Asynchronous interface. ● Hardware and software flow-control. ● Automatic speed detection to line. ● Redial last number. ● Actual service tone detection. ● Monitor speaker. ● Operating environment O°. 45°C, 0-95% Relative Humidity. ● Made in Australia.

TULPI I.M. Series Optional Features: (1987)
● Time and date clock.
● Non-volatile memory.
● Voice and data interactivity.
● Tuneable line hybrid.
● Synchronous user link.
● Extra low voltage output.
● 115V/230V power supply.
● 32K byte program ROM.
● 32K byte RAM.

Future enhancements:
Planned for released include ● 'Check Point'™ security access software. ● V.22bis line speed (2400bps). ● 9600bps line speed on PSTN and Private Line. ● 'MeterMaid'™ connection.

Data Rates: 75 to 1200bps on Telecom line. 75 to 19,200bps on DTE link.

Data Formats: Serial binary, asynchronous, 5, 6, 7 or 8 data bits; 1, 1.5 or 2 stop bits; odd, even, none, force one or force zero parity.

Intelligence: Intel 8085 microprocessor with 12K byte control program.

Modem Compatibility:
CCITT V.21, V.22, V.22(bis) (1987), and V.23; Bell 103, 202, and 212A.

PRICES:
● Model T-013 $745.00
● Model T-123, $1650.00
all prices include sales tax.

Manufacturer reserves the right to change product specifications and prices.

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Tulpi Intelligent Modems
Quality that stands the test of time

The computer products with enough integrity to build out obsolescence!

Non-obsolescence — Guaranteed for 5 years!
TULPI Intelligent Modems, the multi-speed multi-function modem family, are uniquely designed to stand the test of time. They are actually built just like your computer system. In fact, they have their own micro-processor, firmware, RAM memory and I/O controller. This means that just like your computer they can expand and change to meet your telecomputing needs — now and in the future.

Similarity in modems is only skin deep.
Many modem makers today quote tired sounding phrases like: "Hayes compatible", "supports videotex", "auto-answer — auto-dial" and more. All jargon which doesn't tell you a thing about the product's quality of operation or user friendliness.

Unlike most other modems, TeleCorp has built-in, the flexibility to expand to meet your future needs or external demands. Owners of the very first Tulpi Intelligent Modems purchased over two years ago have been able to add; 1200/1200 line speed, Touch Tone® dialling, Hayes® compatible 'AT' commands, on-line HELP facilities, automatic speed detection, and other advancements which were not considered to be normally required then, but have since become standard requests. Purchasers of other brands of modems found themselves disposing of earlier aquisitions when their telecomputing needs increased.

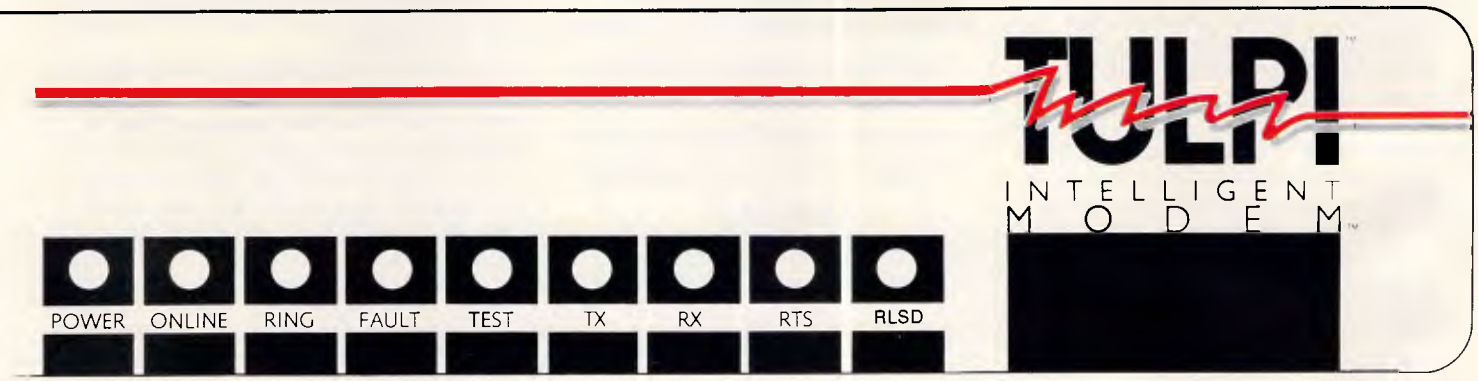
The professional's choice.
The world of Communications is exciting and inviting whether used for business, fun or personal enrichment.

Access information from hundreds of videotex data bases, including VIATEL™. Check the latest share prices. Send two-way messages to your branch offices. Play backgammon with a distant friend. Order inventory from your suppliers. You can even read the news as it happens — 24 hours a day.

Many professional communicators have chosen Tulpi as their passport to this brave new world because of its reputation for reliability, friendliness and expandability.

Tulpi allows your computer to communicate with others across the office or around the world.

Quality engineering, simple operation.
Just plug Tulpi into your computer's serial communication port, and connect its telecom plug into the wall socket. You're ready to communicate with other computers, data bases, stock exchanges and news & information services anywhere in the world.



CAD/CAM PACKAGES

PACKAGE	SUPPLIER	PRICE	CONFIGURATION	2D OR 3D	SPECIALIST APPLICATION
AutoCad 2.1	Logo Computer Centre (02) 819 7307 Entercom Computers (03) 429 9888	$3500	Hercules or IBM Professional Graphics Card, 8087 maths co-processor recommended, DOS, 640K RAM, PC, XT, AT and compatibles	3D	Draughting and design
Cadplan	Technical Imports Aust. (02) 922 6833	$2800	Colour graphics card, DOS, 320K RAM, XT, AT and compatibles	2D	General draughting, engineering and architecture
TurboCad	Busiware (02) 211 1266	$1300	DOS, 256K RAM, PC, XT, AT and compatibles	3D	General drafting and design package
Prodesign	Software City (02) 621 4242	$550	Wide range of graphics cards, DOS, 512K RAM, PC, XT, AT and compatibles	2D	General 2D drawing package

BUSINESS GRAPHICS PACKAGES

PACKAGE	SUPPLIER	PRICE	CONFIGURATION	PRINTERS SUPPORTED	IMPORTED FILES
Chartmaster	SCA (03) 699 7255	$795	DOS 2.1 and above, 256K RAM, PC and compatibles	Most dot matrix and laser printers	All major spreadsheet files
Diagram-Master	Sourceware (02) 411 5711	$659	DOS 2.1 and above, 384K RAM, PC and compatibles	Most dot matrix and laser printers	All major spreadsheet files
DR Halo II	Dimension Graphics (02) 929 5855	$689	DOS 2.0 and above, 256K RAM, PC and compatibles	Most dot matrix printers and HP Laserjet	None, but has screen capture facility
Energraphics 2.0	SCA (03) 699 7255	$795	DOS 1.1 and above, 192K RAM, PC and compatibles	Most dot matrix, laser and inkjet printers, Polaroid Palette	DIF files from Lotus 1-2-3, SuperCalc, Multiplan
Freelance	Sourceware (02) 411 5711	$612	DOS 2.1 and above, 256K RAM, PC and compatibles	Most dot matrix printers and HP Laserjet, most plotters	Lotus 1-2-3 and Symphony PIC files, ASCII files
GEM Draw	Arcom Pacific (07) 52 9522	$299	DOS 2.0 and above, 256K RAM, PC and compatibles	Most dot matrix, laser and inkjet printers	GEM files only
VCN Execuvision	Prentice Hall (02) 939 1333	$632	DOS 3.0 and above, 256K RAM, PC, XT, AT and compatibles	Needs EV Capture Plus	Needs EV Capture Plus
Harvard Presentation Graphics	Imagineering (02) 662 4499	$675	DOS 2.0 and above, 384K RAM, PC and compatibles	Most dot matrix and laser printers	Lotus 1-2-3 and Symphony, ASCII and PFS:Graph files
Graftalk	Fagan Micro Systems (03) 699 9899	$1990	DOS 2.0 and above, 256K RAM, PC and compatibles	Any graphics printers	None
PFS Graph/Plan	Imagineering (02) 662 4499	$215	DOS 2.1 and above, 128K RAM, PC, XT, AT and compatibles	Most dot matrix and inkjet printers	PFS, DIF, SYLK
Microsoft Chart 2.0	Microsoft (02) 452 5088	$415	DOS 2.0 and above, 256K RAM, PC and compatibles	Most dot matrix and laser printers	Lotus 1-2-3, Multiplan, dBase II and III, DIF, SYLK, ASCII files
Graphtime II	Multisoft (09) 322 6637	$99	DOS 2.0 and above 512K RAM, PC and compatibles	Most dot matrix printers	ASCII,SYLK
Graphwriter	Sourceware (02) 411 5711	$995	DOS 2.1 and above, 256K RAM, PC and compatibles	Most dot matrix printers and HP Laserjet, most plotters	DIF files
PC Paintbrush	Sourceware (02) 411 5711	$239	DOS 2.0 and above, 320K RAM, PC, XT, AT and compatibles	Most dot matrix and inkjet printers	ASCII files
Perspective	Megavision (02) 957 5797	$495	DOS 2.0 and above 512K RAM, PC and compatibles	Most dot matrix printers	DIF, SYLK, ASCII

spreadsheet data displayed as graphs in a single document.

PFS Graph is a low-cost package at only $215, but it can do most of the things you'll need it to do. You can import data from other PFS packages, or as DIF and SYLK files from spreadsheets. You can display up to four graphs onscreen at the same time and combine bar and pie charts in a document. There are drawbacks, such as only one font and one font size — plus you are limited in the amount of data you can plot. As in all things, you have to decide what you need for your own purposes.

The other category of low-priced packages includes free-form drawing packages like Digital Research's GEM Draw. You use these to make your own drawings, although most give you a choice of pre-drawn symbols and fonts to choose from. There is one excellent package that bridges the gap between these two areas: Freelance lets you draw freehand with the aid of a library of symbols. But you can also manipulate graphs that you have plotted with Lotus 1-2-3 and Symphony, by importing them as PIC files.

'Higher-quality printers, faster processors, cheaper high-resolution screens and easy-to-use software are all good reasons to start using a graphics package.'

IBM launched two new products in November last year to cover both graphic presentations and free-form drawing. The Colour Graphics Charting Program and the Colour Graphics Application, including the Graphics Editor and Picture Plotting, both run on the 3270/G and GX workstations.

Graphics Charting lets you enter data from the keyboard or transfer it in DIF or SYLK files from other packages. Data is then displayed in a table. You can move around the table cell by cell, changing numbers as you go. Or you can apply numeric calculations and formulae to whole columns. Once you've got the data on screen you can choose from 10 chart types including pie, needle and scattergram. Like the Graphics Editor, Charting has menus to use with a

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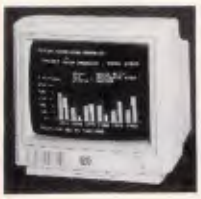

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Band width: 18 MHz
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Includes hard disk controller card.
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Cat. C11953 **$280**

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Slimline 8" Disk Drive, Double sided Density No AC power required. 3ms track to track, 1.6 Mbytes unformatted, 77 track side 10s/su10 bit soft error rate.
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Case & Power Supply to suit
Cat. X11022 **$159**

M4854
Slimline 5¼" disk drive. Double sided, double density, 96 track/inch, 9621 bit/inch, 1.6Mbyte unformatted 3ms track to track access, 77 track/side.
Cat. C11904 **$375**
Case & Power Supply to suit.
Cat. X11011 **$109**

M4853
Slimline 5¼" disk drive, Double sided, double density, 1 Mbyte unformatted, 3ms track to track, 80 track/side, 5922 bits/inch.
Cat. C11903 **$295**

M4851
Slimline 5¼" disk drive. Double sided, double density 500K unformatted, 40 track/side. Steel band drive system.
Cat. C11901 **$249**
Case & Power Supply to suit
Cat. X11011 **$109**

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Cat. C11905 **$385**

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			(Normally $75.00)	
C12602	3022-3000	D/S	$89.95	$85.95
			(Normally $109)	
XIDEX 5¼" DISKS				
C12401	5012-1000	S/S D/D 40 track	$29.95	$28.95
			(Normally $37.50)	
C12410	5022-1000	D/S D/D 40 track	$38.95	$36.95
			(Normally $47.50)	
VERBATIM 3½" DISKS				
C12610	MF350	S/S D/D 80 tracks/135 TPI	$64.95	$62.95
C12612	MF360	D/S D/D 80 tracks/135 TPI	$69.95	$65.95
VERBATIM 5¼" DATALIFE DISKS				
C12501	MD525-01	S/S D/D soft sector 40 track	$27.95	$26.95
			(Normally $44.95)	
C12504	MD550-01	D/S D/D	$34.95	$32.95
			(Normally $49.95)	
C12505	MD550-10	D/S D/D 10 sectors 40 tracks	$61.20	$56.95
C12507	MD577-01	S/S D/D soft sectors 80 tracks	$61.20	$56.95
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C12421		S/S D/D	$22.95	$21.95
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- All pins wired straight through
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P10890	DA15P Male	$2.10
P10891	DA15S Female	$2.25
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P10895	DA15S R.A. Skt	$5.00
P10900	DB25P Male	$2.75
P10901	DB25S Female	$2.95
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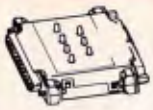
- DIP switches allow easy switching of internal wiring.

Cat. X15662 ..... **$32.95**



RS232 MINI TESTER

- Male to female connections
- All pin wired straight through
- Duel colour LED indicatas activity and direction on 7 lines
- No batteries or power raquired

T.D. Transmit Data
D S.R. Data Set Raady
R.D. Receive Data
C.D. Carrier Detect
R.T.S. Request to Send
D.T.R. Data Terminal Raady
C.T.S. Clear to Send

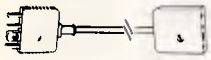
Cat. X15656 ..... **Normally $39.95**
SPECIAL, ONLY $32.95

AUSTRALIAN & U.S. PHONE CONNECTORS

TELECOMMUNICATION PLUG TO 2 SOCKETS.

Ideal for modem connections.

Cat. Y18014 ..... **Narmally $12.95**
SPECIAL, ONLY $10.35



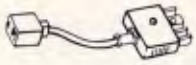
TELECOMMUNICATION EXTENSION LEADS

Cat Y16010 5m **$12.50**
Cat Y16012 10m **$14.95**

TELEPHONE CURL CORD

- U.S. plug to U.S. plug
- Replacement hand set cord
- Length 4.5 metres
- Colours: cream, dark brown.

Cat. Y16022 **$7.95**



TELEPHONE ADAPTOR

- Australian plug to U.S. sockat
- Length 10cm
- Cream colour cable

Cat Y16026 **$6.95**

TELECOMMUNICATIONS AUSTRALIAN STYLE ADAPTOR CABLE

- Auatralian socket to plug/sockat
- Length 10 metres

Cat. Y16015 $15.95

TELECOMMUNICATIONS AUSTRALIAN TO U.S. ADAPTOR CABLE

- Australian socket to U.S plug.
- Length 5 metres

Cat. Y16017 **$7.95**

PRINTER ACCESSORIES

CANON A-40 PRINTER

- Serial Impact Dot Matrix
- 140 C.P.S
- Near Lettar Quality Moda
- 1.4K Buffer

Cat. C20040 ..... **$525**

RS232 DATA SWITCH WITH TESTER

- 25 pin RS232 "U" connectors 2 in, 1 out or 1 in, 2 out.
- Ideal for 2 computers to ona peripheral or 1 computer to 2 peripherals.
- No power required.
- Six dual coloured LED indicators showing certain flow status:
  T.D. Transmit Data
  R.D. Recieve Data
  R.T.S. Request To Send
  C.T.S. Clear To Send
  D.S.R. Data Set Ready
  D.T.R. Data Terminal Ready
- Housed in heavy duty metal cabinet.
- Size: 200(W)x68(H)x150(D)mm

Cat. X19110 **Normally $149**
SPECIAL, ONLY $129

CENTRONICS DATA SWITCH

- 36 pin gold plated female Centronics connectors.
- All other specs as for RS232 Data Switch with Tester.

Cat. X19115 **Normally $169**
SPECIAL, ONLY $149

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Quality paper at a low price! 2,500 sheets of 11 x 9 1/2", 60 gsm bond paper.

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CIC6 6 conductor computar interface cable. Colour coded with braided shield. (to IE422 specifications). Copper conductor 6 x 7/0.16mm.

1-9 metres **$2.50/m** 10+ metres **$2.20/m**

CIC9.100 9 conductor computer interfaca cabla. Colour coded with mylar shielding. 9 x 7/0.16mm.

1-9 metres **$2.95/m** 10+ metres **$2.75/m**

CIC12 12 conductor computar interfaca cabla. Colour coded with mylar shialding. 12 x 7/0.16mm.

1-9 metres **$3.50/m** 10+ metres **$3.20/m**

CIC16 16 conductor computer interface cable. Colour coded with mylar shielding. 16 x 7/0.16mm.

1-9 metras **$4.50/m** 10+ metres **$4.10/m**

DIRECT IMPORT FLAT IDC RIBBON CABLE

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16 Way Cat. W12616		
$1.90	$1.80	$1.70
20 Way Cat. W12620		
$2.50	$2.20	$2.00
24 Way Cat. W12624		
$2.90	$2.70	$2.60
25 Way Cat. W12625		
$3.20	$2.90	$2.70
26 Way Cat. W12626		
$3.60	$3.10	$2.90
34 Way Cat. W12634		
$3.90	$3.60	$3.40
36 Way Cat. W12636		
$3.90	$3.60	$3.40
40 Way Cat. W12640		
$4.90	$4.40	$4.20
50 Way Cat. W12650		
$5.90	$5.40	$5.10
60 Way Cat. W12660		
$6.90	$6.40	$6.10

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Cat. Y16013 ..... **$24.95**

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- U.S. plug to U.S. socket
- Length 10 metres

Cat. Y16024 ..... **$8.95**

U.S. TELEPHONE EXTENSION CABLE

- U.S. plug to 2 U.S. sockets
- Length 10 metres

Cat. Y16028 ..... **$10.95**

JOYSTICKS

JOYSTICK FOR IBM

Features Sa ectable "Spring centering" or free floating". Electrical trim adjustments on both axis. 360 degree cursor control

Cat. C14205 ..... **$49.95**

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Ideal for games or word processing. Fits most 6502 "compatible" computers.

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Durable accurate and reliable, and with dual fire buttons, these new trackballs are suitable for use with tha Commodore VIC-20, Atari homa video game, Atari 400 and 800 home computer and Sears Arcade Gama.

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DELUXE JOYSTICK

Suits Commodore 64, VIC 20, Atari, Sears, NEC PC-8001 computers or video games.

Cat. C14220 ..... **$14.95**

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Features:
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- Comfortable Grip.
- Built in atabilizing Grip.
- Compatible with....
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  Atari,
  Sears
  NEC PC-6001

Cat. C14215 ..... **only $9.95**

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Make your XT work as fast as an AT!! ie: up to 9 times faster!

$995

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Cat. X $175

Mono Graphics Adaptor Card
Cat. X $175

Monochrome Card
Cat. X $119

Colour Graphic Display Card
Cat. X $129

Colour Graphic/Printer Card
Cat. X $189

384K Multifunction Card
(includes cable, but not RAM)
Cat. X $199

768K Multifunction Card
(includes cable, but not 41256 RAM)
Cat. X $199

768K Memory Expansion Card
(41256 RAM not included)
Cat. X $89

Multi I/O and Disk Controller Card
(includes cable)
Cat. X $199

I/O Plus II Card
(Includes cable)
Cat. X $139

Floppy Disk Controller Card
(2 drive capabiiity)
Cat. X18005 ..... $79

Floppy Disk Controller Card
(4 drive capability)
Cat. X $99

Parallel Printer Card
Cat. X18017 ..... $37.50

RS232 Card
Cat. X18026 ..... $59.50

Clock Card
Cat. X $59.50

Clock/RS232 Card
Cat. X $99

Games Adaptor Card
(2 joystick ports.)
Cat. X $39.50

Herd Diak Drive Card
Cat. X $299

IBM* AT COMPATIBLE CARDS

Main Board 6MHz
(with Phoenix Bios)
Cat. X $1.050

Enhanced Graphics Adaptor Card
(Award Bios)
Cat. X $495

PC/XT/AT Serial/Parallel Card
Cat. X $149

Floppy & Hard Disk Controller Card
Cat. X $699

1 M/Byte RAM Card
(Without RAM)
Cat. X $299

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(Without RAM)
Cat. X $299

2.5 M/Byte Multifunction Card
(Without RAM, includes cable)
Cat. X $449

APPLE COMPATIBLE CARDS!

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"Grappler" style card allows hi-resolution screen dumps to your Epson compatible printers. Fully functioned for flexible flow of output.
Cat. X17029 **$89**

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Ideal for use with CP/M. Your computer becomes capable of upper and lower case, with a full width screen of 80 characters. If you want to run Wordstar, or any good wordprocessing software, get this card.
Cat. X17019 **$85**

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Three channel synthesiser can create a single polyphonic output or three monophonic outputs. Control of pitch and volume is possible. Up to three cards can be used at the one time. Complete with demonstration software.
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True high definition colour for your Apple or compatible.
Cat. X17039 **$79**

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Get some colour into your games. Use your Apple or compatible on the second television. Has both UHF and composite video outputs. Fully adjustable so you can fine tune it for a crisp clean image.
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No card does it better. Want to hook in to bulletin boards or mainframes? Turn your computer into a dumb terminal. That's right! This serial card comes complete with software.
Cat. X17035 **$129**

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IC STORAGE CASE

Electro static charge proof plastic IC case with conductive sponge. Dimensions: 75 x 130 x 19mm.
Cat. H10095 **NORMALLY $8.95**
SPECIAL, ONLY $7.95

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IC INSERTERS

14-16 pin T12187	$8.95
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P17016 16 pin	$14.50
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P17028 28 pin	$19.50
P17040 40 pin	$22.50

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UV EPROM ERASER

Erase your EPRDMs quickly and safely. This unit is the cost effective solution to your problems. It will erase up to 9 x 24 pin devices in complete safety, in about 40 minutes (less for less chips).
Features include:
- Chip drawer has conductive foam pad
- Mains powered
- High UV intensity at chip surface ensures EPROMs are thoroughly erased
- Engineered to prevent UV exposure
- Dimensions 217 x 80 x 88mm

Without timer Cat. X14950
Special, only $79.95

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IC SPECIALS!

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5558pin	0.50	0.40	0.35
4116	$3.95	$3.75	$3.50
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2716	$5.90	$5.50	$5.50
2732	$6.25	$5.95	$5.50
2764	$6.25	$5.95	$5.00
27128	$6.95	$6.50	$6.25
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41256	$5.95	$5.50	$4.95
6264	$6.50	$5.50	$5.25
27256	$11.50	$10.50	$10.00

WORLD MODEM CHIP

Cat. U21614 Normally $49.50
Save $20, SPECIAL $24.95

MEL9501

Have you blown up your Apple drive by plugging it in backwards or not turning off the power while changing bauds? We have the MEL9501 chip!
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Here's what you've been asking for. a full trasmit-receive system for computer driven radio teletype station. The software provides all the latest "whizz-bangs" like split-screen operation, automatically repeating test message, printer output and more. The hardware uses tried and proven techniques. While designed to team with the popular Microbee, tips are avaialble on interfacing the unit to other computers. (ETI Nov.'84) ETI 755)
Cat. K47550 **$135**

EPROM PROGRAMMER EP1 KIT

No need for a Micro with EA's great Eprom Programmer suitable for 2716/2758 Eproms.
(EA Jan.'82) 82EP1

Cat. K82013 **$79.95**
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ARGUS 726 ADJUSTABLE MAGNIFIER WITH LAMP

Absolutely perfect for close up work! Intricate PCB's, projects, etc., will be a breeza under this superb, adjustable magnifying lamp.
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The RITRON Multi Purpose Modem has all the features you require...
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- Bell 103 300 Full duplex
- Bell 202 1200 Half duplex
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Telecom Approval No. C84/37/1 134
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For computers not capabla of split baud rates. Buffers characters at 1200 and converts to 75 baud
Cat. X19105 **$99**

PARALLEL PRINTER SWITCH KIT

Tired of plug swapping when ever you want to change from one printer to another? This low-cost project should suit you down to the ground. It lets you have two Centronics-type printers connected up permanently, so that you can select one or the other at the flick of a switch.
(ETI 666, Feb. '85)
Cat. K46660 **$79.95**

300 BAUD DIRECT CONNECT MODEM KIT

Think of the advantages of having your own modem!!
- Can't afford a floppy disc? Use your telephone to access one for the cost of a call.
- Bored with your old programs? Download hundreds of free programs.
- Want to get in touch with fellow computer enthusiasts? Use 'electronic mail'.
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(ETI 699, May '85)
Cat. K46990 **Normally $129**
SPECIAL, ONLY $109
(Short form without phone)

VALUE!

150W IBM COMPATIBLE SWITCH MODE POWER SUPPLY

DC output: +5/13A, -5V/0.5A +12V/4.5A -12V/0.5A
AC input: 240V AC +-15% 1.5A 47Hz - 63Hz
Cat. X11096 ..... **Normally $239**
Now only $179

5¼" DISK STORAGE

Efficient and practical. Protect your disks from being damaged or lost!
Features...
- 50 disk capacity
- Smoked plastic cover
- Lockable (2 keys supplied)
- Dividers/spacers

Cat. C16030 ..... **only $19.95**

5¼" DISK STORAGE

Efficient and practical. Protect your disks from being damaged or lost!
Features...
- 70 disk capacity
- Smoked plastic cover
- Lockable (2 keys supplied)
- Dividers/spacers

Cat. C16025 ..... **only $24.95**

3½" DISK STORAGE UNIT

- Holds up to 40 x 3½" diskettes.
- Lockable (2 keys supplied)
- High impact plastic lid and base
- Anti static

Cat. C16040 ..... **only $19.95**

3½" DISK STORAGE UNIT

- Holds up to 40 x 3½" diskettes.
- Lockable (2 keys supplied)
- High impact plastic lid and base

Cat. C16035 ..... **only $19.95**

PROTOCARD FOR IBM*

- Size 335 x 101mm (approx.)
- 5,000 holes (approx.)
- 1mm diameter
- Double sided
- Plated through
- Solder pad both sides
- Gold plated edge connector

Cat. H19110 ..... **$49.50**

EPROM PROGRAMMER KIT

If you have ever wanted to rewrite or extend the operating system of your microcomputer or if you're interested in dedicated microprocessor applications then this EPROM Programmer is just the thing. It is an inexpensive unit that uses readily available IC's, interfaces directly to the expansion bus on the back of all the popular 8080/Z80 microcomputers and programs 2708's, 2716's, 2758's and 2732's.
(EA July '80) 80PP71
Cat. K80074 **$79.50**
(Horwood case supplied)

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Quality, 20 minute computer data cassettes at unbelievable prices!!
Cat. X12020

1-9	10+	100+
$1.20	$1.00	$0.90

mouse.

Graphics Editor works alongside another product from IBM, GDDM (Graphical Data Display Manager). It uses Picture Interchange Format (PIF) files that can be read by GDDM on the host. So you can work on a picture on your 3270 PC then transfer it to the host library to be stored or printed out on a high quality printer.

A Graphics Editor screen has Macintosh/GEM type icons around its edges. It does not work with the usual pull-down menus, however, but displays a new set of options when you pick a command or design tool. IBM describes Graphics Editor as being somewhere between AutoCad and Execuvision. It's certainly a powerful package but you have to have special hardware to run it, so it is more suitable for serious design applications than mere business graphics.

That leads us on to the next category of packages: AutoCad, TurboCad and Cadplan are just three of the many low-cost, high performance 2D/3D drafting packages on the market. Rather than go for a specialist area of design, the authors have aimed their packages at users who want general drafting programs. AutoCad is a basic package to which you can add specialist modules, turning it into architectural or engineering software.

The advantages of these packages are their flexibility, ease-of-use and low cost. Autodesk, author of AutoCad, claims to supply 80 per cent of the power of a mini-based graphics system for a fraction of the cost. To run the majority, all you need is a Hercules card, an extra 8087 co-processor and a colour screen.

END

'Malcolm's been commissioned to program next year's Eurovision Song Contest entry.'

Monitoring your pixel power

Improved software is now making greater demands on the quality of display that you use. Des Lorimer looks at some of the options available.

If you can cast your mind back a few years you might recall that television sports commentator during a snooker championship saying: 'For those watching in black and white the blue ball is positioned directly behind the pink'. This does have some bearing on what sort of monitor you should purchase for your PC.

For example, if you only want to watch chess or old black and white films on television there is not much point in buying an expensive colour set. There again, if you are a snooker fanatic black and white can be frustrating, commentator or no commentator. It is much the same with monitors, it all boils down to what application you want to run.

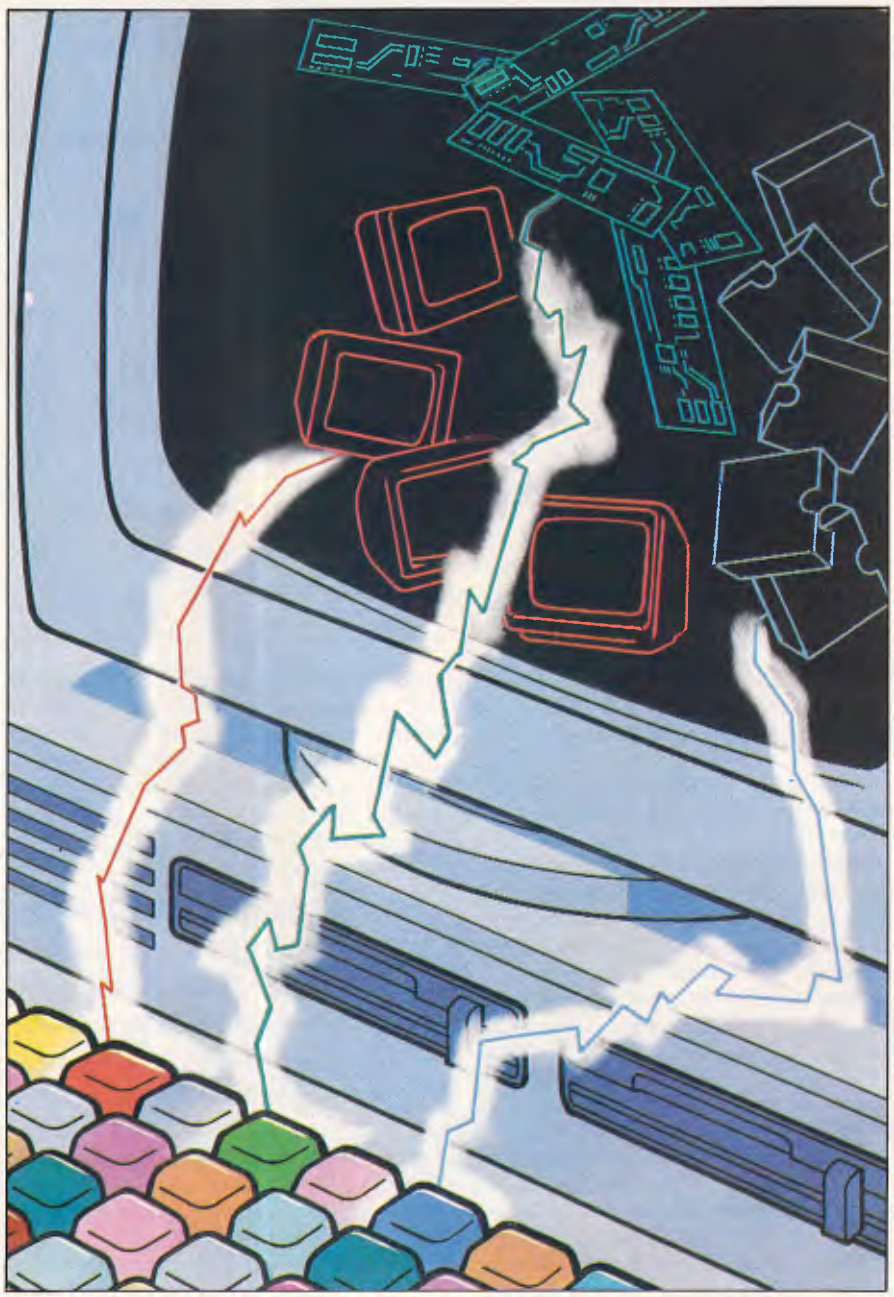
So what have you got to choose from? There are five basic types of monitor available for PC users — two monochrome and three colour. In the mono field you have composite video and Transistor-Transistor Logic (TTL). The three colour or RGB (red/green/blue) types are RGB/Analogue, RGB/TTL and RGB/Analogue composite.

Composite video, similar to a television signal before it is broadcast, combines factors such as colour, brightness and horizontal/vertical hold into one signal that can be passed through a single set of wires.

TTL uses separate wires to transport each individual signal and tends to produce a higher quality display.

Horizontal frequency is becoming increasingly important in the present batch of monitors on the market. This controls which phosphor dot is lit up on the monitor's display tube at any particular moment. The higher the frequency, the better the quality of the image. Originally the frequency was 15.75 KHz for composite monitors. This was boosted up to 18.43 KHz with the IBM-type TTL monitors, and is now up to around 24.75 KHz on some monitors.

Each monitor's display capability can



MONITORS

Product	Type	Maximum Resolution	Supplier	Price
ADI/DM14	14-inch mono	1,000 lines at centre	Imagineering (02) 662 4499	$380
ADI/PX22	14-inch colour	720 x 350	Imagineering (02) 662 4499	$1425
IBM Colour	13-inch colour	640 x 200	IBM (02) 923 5123	$1027
IBM Enhanced	13-inch colour	640 x 350	IBM (02) 923 5123	$1761
IBM Monochrome	12-inch mono	720 x 350	IBM (02) 923 5123	$436
Taxan/KX 1212	12-inch mono	1,000 lines at centre	Megavision (02) 957 5797	$370
Taxan/KX 1213	12-inch mono (amber)	1,000 lines at centre	Megavision (02) 957 5797	$380
Philips/CM 8533	14-inch colour	285 x 600	Philips (03) 542 3600	$449
Princeton Graphics/MAX-12	12-inch mono	720 x 350	Intelligent Systems (03) 543 7988	$337
Princeton Graphics/HX-12E	12-inch colour	640 x 350	Intelligent Systems (03) 543 7988	$1037
Qubie/HR 31 200	14-inch colour	640 x 200	Qubie (02) 534 6000	$999
Qubie/HR 39	12-inch mono	720 x 350	Qubie (02) 534 6000	$400
Samsung GR2F	12-inch mono	720 x 350	Amust (03) 555 3644	$225
Sanyo CRT30	12-inch mono	720 x 350	Sanyo (02) 929 4644	$379
Sanyo CRT40	12-inch mono TTL	720 x 350	Sanyo (02) 929 4644	$389
Sanyo CRT80	13-inch colour	640 x 200	Sanyo (02) 929 4644	$995
Taxan Supervision IV	12-inch colour	640 x 400	Megavision (02) 957 5797	$1425
Taxan Supervision III	12-inch colour	640 x 262	Megavision (02) 957 5797	$1065
Taxan 1222	12-inch mono	1000 x 400	Megavision (02) 957 5797	$475
Thomson Grand CM 31311 SI	12-inch colour	690 x 240	Pacific Data Corp (02) 290 1122	$860
Thomson Grand CM 31381	12-inch colour	640 x 240	Pacific Data Corp (02) 290 1122	$860
Thomson Grand MM 3102	12-inch mono	1,200 lines at centre	Pacific Data Corp (02) 290 1122	$265
Wyse/WY-700	15-inch mono	1,280 x 800	Imagineering (02) 662 4499	POA

be measured by the minimum bandwidth for signals that it is capable of receiving. To display 60 pixels on a line, 1MHz is required and it takes a minimum of 9MHz to produce a reasonable picture. Televisions transmit at 4.5MHz.

A dedicated graphics card, such as the IBM EGA, is required by some monitors, although a general purpose card that can run several different types of display seems to be the latest trend.

The majority of monitor manufacturers make both monochrome and colour displays.

The market is highly competitive, and prices vary from $200 to $2000. One of the better known brands in Australia is Taxan, distributed through Megavision. Many corporate PCs can be seen sporting Taxan monitors.

New to the Australian market is Samsung, distributed through Amust. Samsung is the biggest manufacturer of monitors in the world, producing some 1.1 million units per month, some of which eventually find their way into Macintoshes, HP and NEC machines. Samsung has a turnover which is 15 per cent of Korea's G.N.P.

Hitachi also produces many monitors which, until recently were available in Australia. Hitachi uses an agent for their PC products here, but this agent no longer handles the monitors.

'Some monitors require a dedicated graphics card such as the IBM EGA, or a general purpose card that can run several types of display.'

Princeton Graphics Systems has been in the business of manufacturing monitors for some time. The company introduced its first monitor, the HX-12 RGB colour, in October 1982. It now offers a complete line of monitors for the IBM PC and compatibles.

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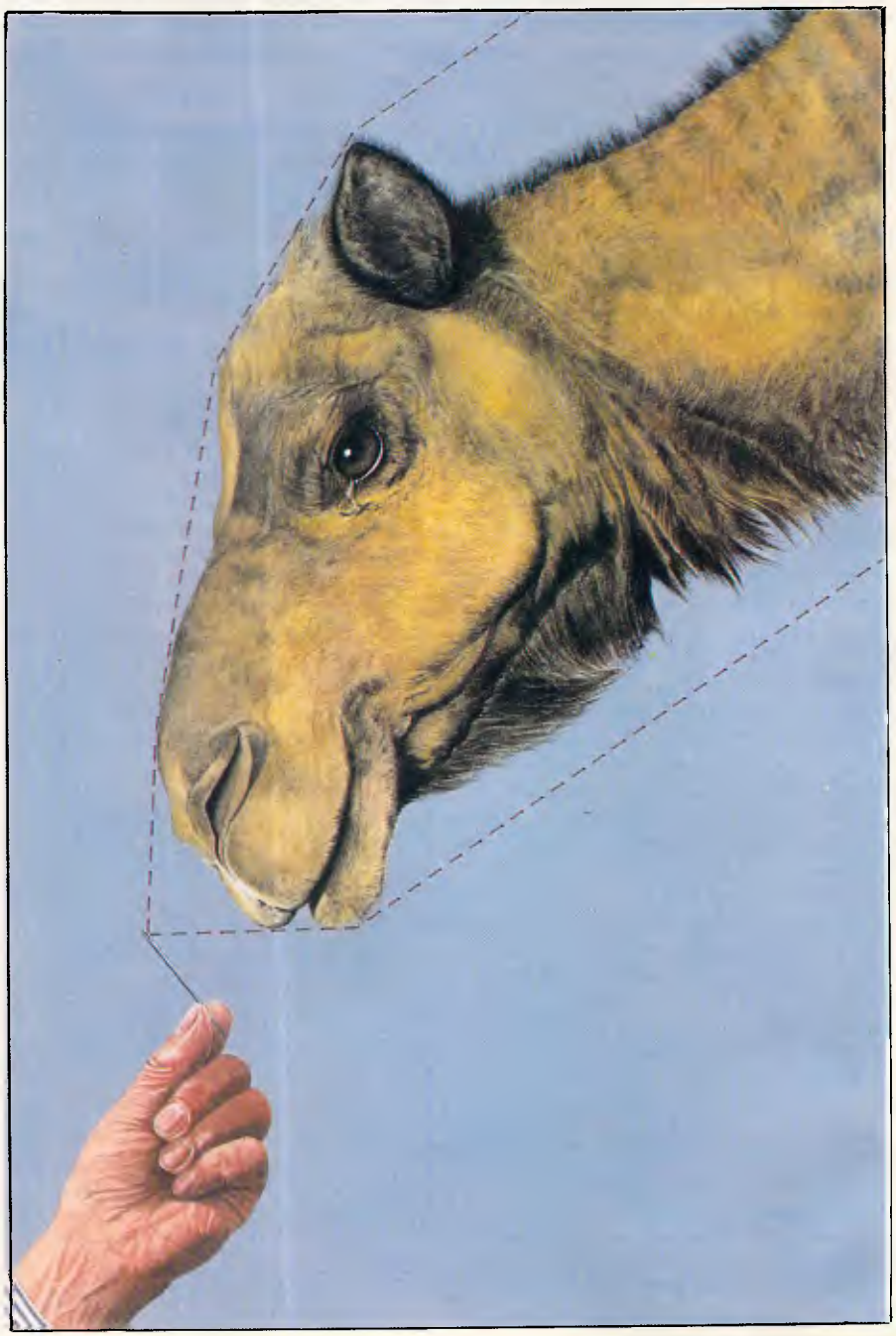
One lump, or two...

Subroutines have an important part to play in structured programming. Mike James discusses their implementation in computer languages.

This is part three of a six-part series on programming methods and the creation of programs. Parts one and two appeared in the July and August issues, copies of which are available from APC *Back Issues.*



One of the most powerful ideas in modern programming is the use of subroutines to reduce a difficult, if not impossible problem to a number of smaller, more manageable, problems. The use of subroutines in this way is one of the central tenets of all programming methods, but there are still programmers who think of subroutines as merely an easy way of repeating some standard action without having to write the necessary lines of code each time.

Part of the reason for this is that a number of high-level languages do not provide very good facilities for subroutine creation and use. For example, the Basic subroutine is a crude shadow of the earlier Fortran subroutine and even enhanced versions of Basic leave a lot to be desired when it comes to the provision of subroutine-like facilities.

Basic is not alone in its neglect of the subroutine, but it is perhaps the most important in that it is the best and most used teaching language available. For a programmer to think that the Basic subroutine is a reasonable example of the species is a frightening situation that occurs all too often. In this article the broader idea of a subroutine or module is discussed along with some of the ways that this idea has been implemented in other languages.

The granular program

A program is a list of instructions and any useful program is likely to be a very long list of instructions! When we first started to write programs, this idea of creating a long list of instructions was the only

theoretical guideline available and many assembly language programs were, and still are, written as a monolithic block of code. You can write such programs using traditional structured programming methods, and as long as you avoid transferring control around the program in a haphazard way using direct jumps or GOTOs, the result will be well-structured and fairly easy to understand. However, if you take a program that has been written in this way and try to make sense of it, you will discover that it has an additional structure that its programmer may not have been aware of.

When you examine any list of instructions you will usually discover that various parts of it are dedicated to performing particular identifiable jobs. In other words, even if a program has been written as one long list of instructions, it still has a 'granular' structure composed of a number of sublists, each of which deals with a particular task. If you look more closely at the program you will see that each of the sublists is composed of a number of sublists, and so on — that is, the granular structure of a program is hierarchical. The program performs a particular task as a number of distinct subtasks, which are themselves in turn composed of a number of subtasks, and so on. The important thing to notice is that this hierarchical granular structure is a natural property of programs rather like the atomic nature of matter.

Avoiding big programs

Given that programs have a granular structure, it seems reasonable to make use of such a structure. By making the granules clear and explicit you are working with the natural structure of the program rather than ignoring it.

However, there is a much more important reason for taking account of the granular structure of programs. Most programmers start out by writing short 10-20 line exercises. When you are first learning to program, such tiny programs are hard enough because you have to think about the details of the language as well as the correct algorithm. After a little practice such short programs become easy and the time is right to tackle something larger. The only trouble is that there is no general recognition of the fact that large programs need a completely different writing technique to small programs. Indeed, large programs present a wholly new type of problem to the construction of program snippets.

The reason for this is simply the limitation of human memory. When writing a short program you can, usually, keep it all in your head. When writing a large program, you can at first keep it all in your head but eventually there comes a time when you have written more lines than your memory span can encompass, and from then on it's all down hill. You can write large programs by brute force and a super-human effort to remember everything, but the alternative, rather more intelligent method is much less effort.

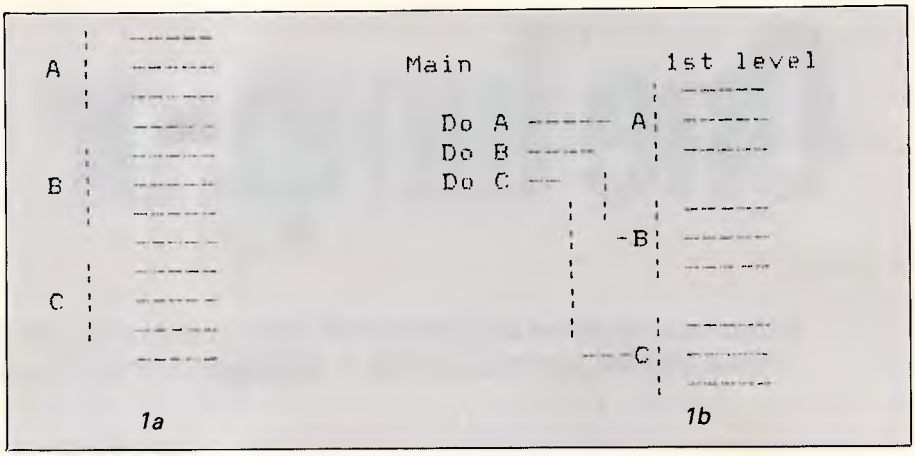


Fig 1a & b The hierarchical nature of a program

The key to the easy and successful writing of large programs is not to write them at all! From the discussion in the previous section you should by now be convinced that a large program is in fact made up of a collection of smaller functional units, each dealing with a particular subtask. Rather than write a single large program it is much easier to write a number of smaller units or modules, each one small enough to hold in your memory, and then use these to construct the complete program. This programming method is usually known as *modular programming* and the most successful programming method in use today is known as *modular structured programming* indicating the combined use of modular construction and well-structured code within each module.

The hierarchy

It's not just that programs are granular that is important, it's that they are composed of a hierarchy of grains — that is, each program is made up of modules and each module is made up of modules, and so on: not quite *ad infinitum* but down to modules that can accomplish their task using only a few statements from the language in use.

Programs are even easier to understand and to write if this hierarchy can be made explicit, so that a single level of the hierarchy can be seen in one go without the distraction of being able to see smaller modules at other levels. For example, if you look at the first program in Fig 1, you can see that it is made up of three modules A, B and C, and that these modules are used in turn one after the other. However, in a real program you would not find this quite so easy to see because the lines of code that

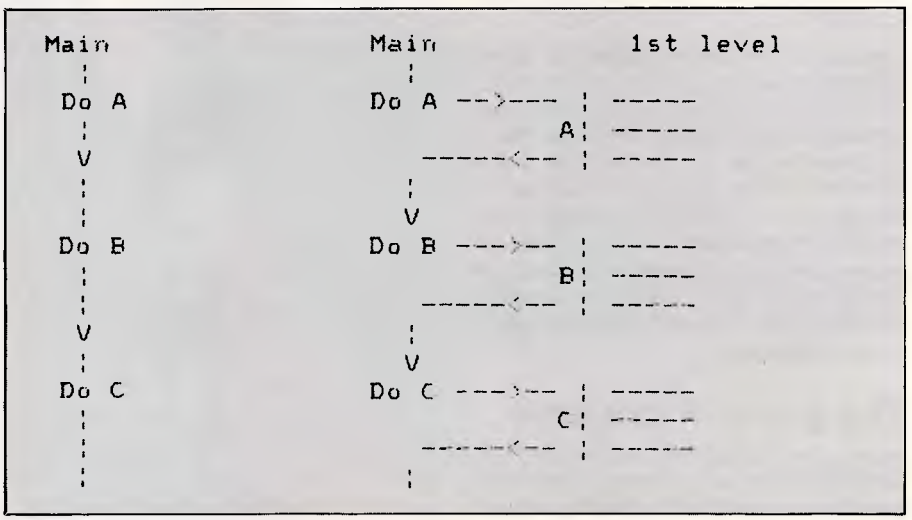


Fig 2 The simplicity of not following the hierarchy!

make up the definition of each module might extend over a number of pages.

A much better organisation that accurately reflects the hierarchical nature of the program can be seen in the second layout in Fig 1. Using this layout you can look at the topmost level of the hierarchy — the main program — and immediately see the coarse structure of the program without being distracted by the details of the other levels. Of course, in a real program each of the modules at the next level would be composed of references to modules at other levels, and so on.

This hierarchical layout implies that whatever programming language is being used provides the faciilty to give a name to a collection of statements, and to cause them to be executed simply by using that name. What is surprising is that not all high-level languages are that sophisticated. For example, the only facility that Basic offers for this sort of organisation is the GOSUB and RETURN commands and this limits the Basic programmer to naming modules according to the line number they start at, and it encourages the bad habit of thinking of a subroutine call as a transfer of control similar to a GOTO. If you think of a GOSUB as nothing more than a fancy form of the GOTO instruction, there is the temptation to follow the flow of control in the same way and so lose any advantage that an explicitly hierarchical structure gives you. For example, the flow of control in the main program in Fig 1b is simplicity itself — it is just the default flow of control — Do A, Do B and then Do C — but if you follow the transfers to the modules in the next level, it is amazingly complicated — GOSUB A:RETURN:-GOSUB B:RETURN:GOSUB C:RETURN — see Fig 2.

And, of course, if you are persistent enough to follow each transfer down through all the levels of a hierarchy, not only do you immediately lose the benefit of this sort of organisation, it is actually worse! The important point is that, in the main, a program should be understood and written at one level of the hierarchy at a time and the temptation to jump between levels should be resisted.

Top down programming

If you are going to create a program with an explicitly hierarchical structure, then you might as well make use of this to guide you while the program is in the formative stages. In particular there is a programming method called 'stepwise refinement' that is particularly good at exploiting the hierarchy. In stepwise refinement you first concentrate on defining the topmost level in terms of calls to subroutines that are to be fully implemented at a later date. For example, if you want to implement a program to play a game of noughts and crosses, the usual problem is getting started, but using stepwise refinement the main program can be written almost at once —

```
      GOSUB setup
LOOP  GOSUB play—X
      GOSUB play—O
      IF NOT WIN THEN GOTO
      LOOP
      GOSUB end—game
```

You might think that writing the main program hasn't made much progress but you would be wrong! The problem is now broken down into a number of sub-problems, each of which can be tackled independently and further split down into sub-sub-problems. A more important gain is that now the overall structure of the program is revealed to be a conditional loop — in effect the main program says 'keep playing until somebody wins and then report who won.'

The next stage of the refinement is to fill in the details of the subroutines used at the topmost level, and so on, down to the lowest level in the hierarchy. Because of the way that stepwise refinement works down the hierarchy it is known as a *top down method,* and hence the complete name of the most successful programming method we know is Top Down Modular Structured Programming, or just TDMSP for short! It is possible to attack problems in other ways than top down. For example, for some projects a bottom-up approach is justified (although this is rarely efficient). In reality most programs are constructed by a more flexible moving around the hierarchy than pure theory would suggest. It is usual for a programmer to identify particular 'difficult paths' down through the hierarchy and work on those first.

In the case of the noughts and crosses programs, for example, it is very likely that very little attention would be given at first to the human player's move and more time and priority would be accorded to the part of the hierarchy concerned with the machine's move. There still is a lot of work to be done in researching exactly how programmers exploit a program's hierarchy, but there is no doubt that good programmers do it mainly top down!

Interaction

If dividing a large program up into smaller pieces is going to make it easier to write, then it is essential that each small piece can be written without reference to the rest. If this is not the case, then you cannot concentrate on a section of program small enough to hold in your head because you have to keep track of the rest of the program, even though you are only working on one small subroutine. This is the principle of non-interaction, and real subroutines, especially Basic subroutines, do not come anywhere near obeying it! For example, if you are writing a Basic subroutine, then you have to be aware of the names of all the variables and line numbers already used in the rest of the program. As a program gets bigger this burden of remembering variable names and line numbers increases to the point where a mistake is almost certain, and mistakes of this sort are almost impossible to find because they cause

Inside information: expressions and functions

All the real work of a program is performed by the evaluation of expressions. The most common example of an expression is the arithmetic expression (that is, simple arithmetic) but there are also other types of expression.

An expression is simply a recipe for working out a result by combining various data values. In this sense every expression 2*3+4*5 is equivalent to the program — Step 1: mutiply 2 by 3. Step 2: multiply 4 by 5. Step 3: add the results of step 1 and step 2 together. (Some primitive programming languages — most assemblers, for example — do not support expressions and as a result all calculation has to be done a step at a time).

In the same way that a program can be divided down into smaller subroutines, an expression can be broken down into smaller units of calculation called functions. For example, the calculation of sin(x) is quite involved but you can use it in an expression by simply writing the function SIN(X). When the computer encounters a function in an expression it essentially executes a subroutine that returns a single value — the result of the function. Thus functions are a special restricted form of subroutine that return one, and only one, value as a result so that they can be used as part of an expression.

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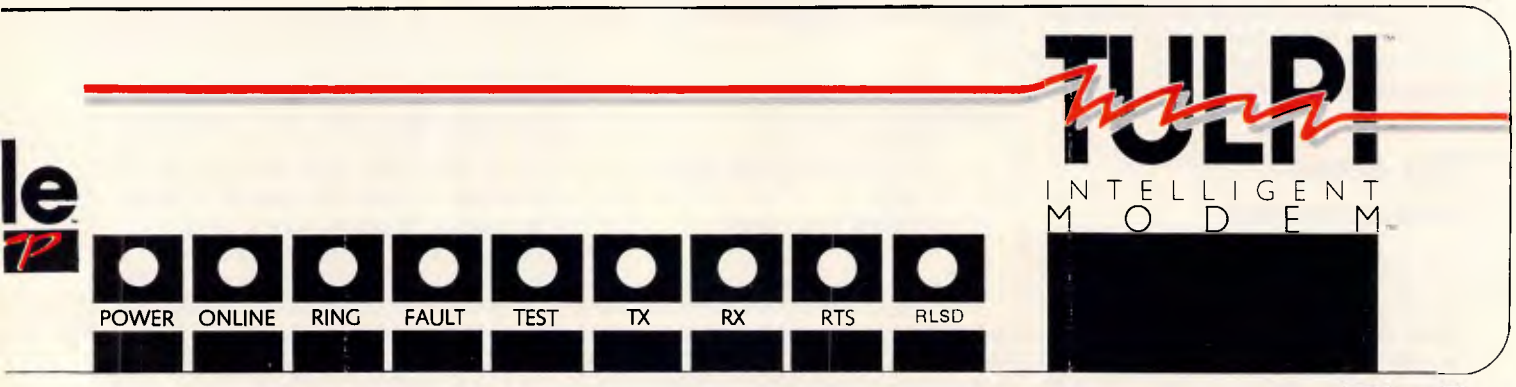

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apparently perfect subroutines to stop working.

Of course, a complete application of the principle of independence is equally undesirable. The reason for this is that to make a program work as a whole, subroutines have to interact. They have to receive data from other subroutines, process it and then pass the results on, and this means they affect each other and even in an ideal world subroutines cannot be written without reference to one another. The point is that there are wanted and unwanted interactions between subroutines. Unwanted interactions are often called *side effects*, and a good subroutine facility should make it possible to write subroutines without having to worry about the chance of side effects.

Before discussing methods of controlling interactions it is worth classifying the type of variables that a subroutine may use. Some of the variables used by a subroutine are for its own internal use and have nothing to do with any variables used in other subroutines. Other variables are used to transfer data into or out of a subroutine and these constitute the 'glue' that joins subroutines together to form a complete program.

Visibility and scope

The first step to minimising side effects between subroutines is to make sure that every subroutine has its own set of internal variables that have nothing to do with any variables of the same name in other subroutines.

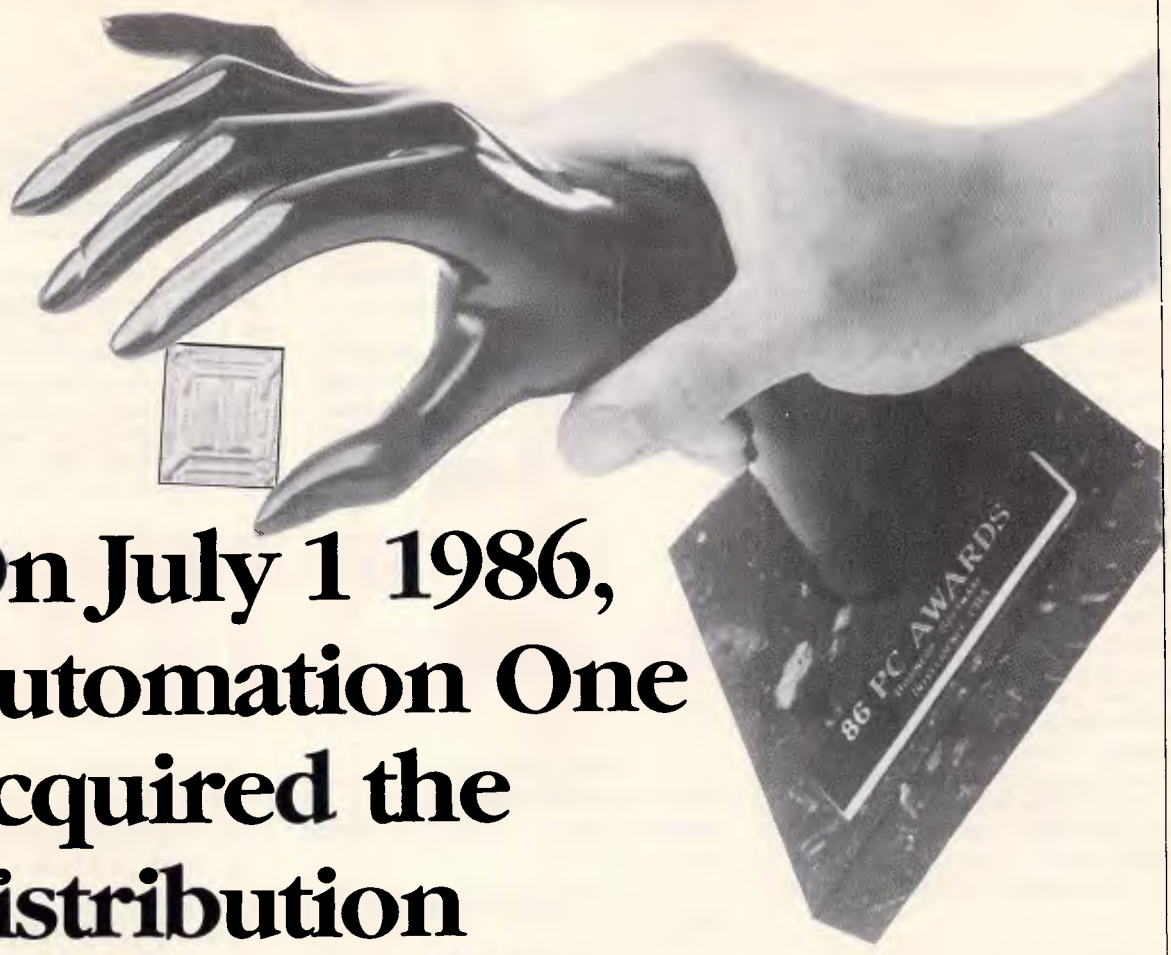
This idea will be strange to many Basic programmers because in Basic each variable that you use in a subroutine is available or *visible* in every other subroutine. Variables that are visible from any point in a program are called *global* variables. In other languages and in some dialects of Basic it is possible to define variables that are only visible within a given subroutine. Such variables are called *local* variables and it is clear that whenever possible all internal variables should be defined as local.

As well as global and local variables there are other ways in which the visibility of a variable can be restricted. In particular, it is possible to make use of the hierarchy of subroutines to define the *scope* of a variable. The scope of a variable is just the range of subroutines from which it is visible.

In many languages a hierarchical scope rule is used, and this just corresponds to variables that are defined in a subroutine being visible from every subroutine lower in the hierarchy. For example, if subroutine 1000 defines a variable TOTAL, then this variable will be visible and hence available in any subroutines that are called by subroutine 1000 but not from subroutines that call subroutine 1000. This hierarchical scope is useful because it automatically follows the flow of data up and down the hierarchy. A variable that is only defined in a lower level cannot be used to transfer data to and from higher levels, only to and from lower levels. The combination of scope rules and local variables can be used successfully to control side effects between subroutines while ensuring that information that has to pass

Creative challenge 3

Write a program, in your own dialect of Basic, that will draw a person's face using rectangles for all the features. Then change it so that all of the features are drawn with circles. *Remember to make use of the hierarchy.*



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Answer to creative challenge 2

Most programmers overreact to the sort of problem that involves 'connectedness'. If you are only interested in answering a question about whether town A is connected to town B without any details of how they are connected, then there is no need to create a data structure to represent a map of how they are connected. Instead all you need to model is the fact that each pair of towns is either connected or not connected, and this can be done using an array of zeros and ones — that is, a '1' in C(I,J) means that town I is connected to town J and a 'O' would mean that they were not connected!

How such a matrix is constructed is not really part of the problem set in creative challenge 2, but you could either work out which pairs of towns are connected by hand or by repeatedly squaring a matrix of nearest neighbour connections. (If A is a matrix of direct connections, A^n is a matrix of nth order connections). The important point about this example is that it is important not to over-model or over-represent reality. The data structure that you use should be the simplest that will do the job.

between them does. Most of this is of academic interest to the Basic programmer because all Basic variables are global, but in languages such as Pascal and Modula hierarchical scope is the norm.

Existence

The existence of variables is another strange idea to most Basic programmers because in Basic, once you define a variable, it exists until the program comes to an end. However, this is a rather simple approach to the existence of variables. For example, in Pascal a variable that is defined in a subroutine (Pascal subroutines are called procedures) exists only for as long as the subroutine is being executed.

This fits in with the hierarchical scope rule because when a variable isn't visible it no longer exists and hence doesn't use any storage, but it also has one or two additional consequences. In particular, if the variables that a subroutine defines come in and out of existence as the subroutine is used, it cannot accumulate information.

For example, in Basic (and in Fortran) you can use a variable to count the number of times that a subroutine has been used by including a statement of the sort USE=USE+1 at the start. But in languages such as Pascal this doesn't work because the variable USE would be destroyed each time the subroutine came to an end. In other words, in Pascal a subroutine's internal variables are considered to be temporary or scratch storage.

Parameters

The best known method of passing information into and out of subroutines is the use of *parameters.* Parameters are the ultimate way of restricting the way that subroutines can interact. If we assume that all variables are local to the subroutine in which they are used, then parameters are just a way of establishing contact between particular variables in different subroutines. For example, if you have written a subroutine that will print a number of blank lines —

```
  FOR I=1 to N
  PRINT
NEXT I
RETURN
```

then I is clearly an internal variable and N is an input variable that determines the number of blank lines printed. Without the use of parameters any subroutine that uses this blank line printer has to set the variable N to an appropriate value, but it may already be using some other variable, COUNT say, for this purpose. Using parameters this difficulty over naming doesn't arise, because if N is defined to be a parameter at the start of the subroutine (using BBC Basic)

```
  DEF PROCblank(N)
  rest of subroutine
ENDPROC
```

then the connection between COUNT and N can be made when the subroutine is called —

```
PROCblank (COUNT)
```

In this case the value stored in COUNT is used to initialise N before the subroutine is executed. This is a one-time transfer, and after this the variables COUNT and N are completely independent — that is, changing the value of N within the subroutine will not change the value stored in COUNT. This sort of parameter is called a *value parameter* and it is clearly good for getting information into a subroutine but useless for getting it out.

There is a second and slightly more complicated sort of parameter called a *variable parameter.* In this case the connection between the two variables is made for the duration of the subroutine's execution and so, for example, changing the value of N would then change the value of COUNT. Clearly, variable parameters can be used to transfer information into and out of a subroutine. END

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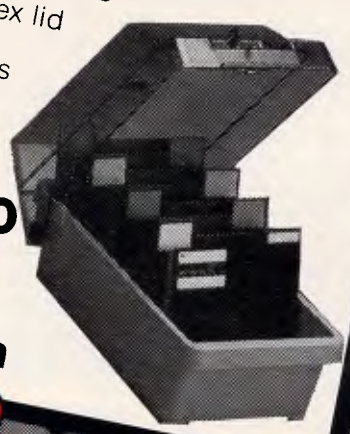

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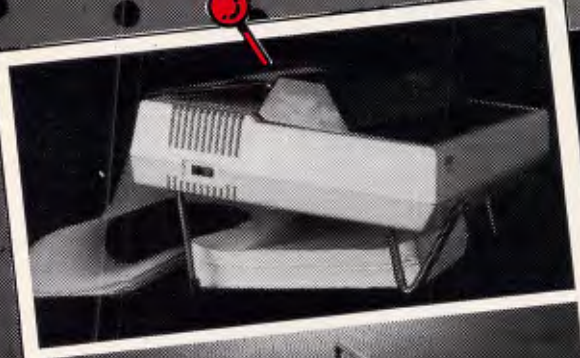

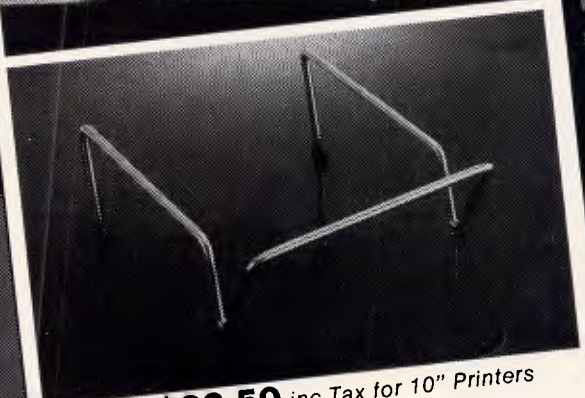

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64/128 IEEE 488 interface

The IEEE 488 Interface from Brainbox allows the connection of real Commodore disk drives to the 64 and the 128. Barry Miles explains how.

With the arrival of the Commodore 128, the field is open for yet another flood of add-ons such as those available for the Commodore 64; Brainbox's IEEE 488 interface is one of the first of these to appear. Priced at approximately $250, this very small package, not much larger than a conventional cartridge as used in a Commodore 64, offers an interesting and convenient set of utilities.

The interface's main function is to enable the Commodore 128 or 64 user to hook up his machine to one or more of the many and various IEEE devices on the market. In particular, it enables the fast parallel IEEE disk drives which Commodore has manufactured in the past, and is still manufacturing, to be used with the 128 and the 64.

One of the notable design features of the Commodore 128 is the continued use of the infamous 'slow serial bus' with which users became infuriated on the 64. It's true that the 1571 disk drive, which has been produced for the Commodore 128, does operate quickly. It has a Burst mode for particularly high speed operations, and is a double-sided, quite densely packed disk.

However, many Commodore 128 users will be people who have upgraded from using Commodore Pets. They may well have not bothered to buy a Commodore 64, or may be buying the 128 as an upgrade from that machine. In either case, they may have available the well regarded 4040 disk drive or even perhaps the 1001, 8050 or 8250 drives. The truly affluent user may even have Commodore's hard disk!

It's extremely frustrating to find that these disk drives cannot be used with the 128. The same applies to the rather lengthy series of Commodore IEEE parallel printers, which are not compatible with the 128 or 64 computers either.

Implementation

The Brainbox Interface plugs into the memory expansion socket on the Commodore 128 or the 64, which is normally referred to as the cartridge slot. This slot is replicated on the top of the box so that the use of the interface does not prevent your being able to plug in additional memory expansion modules,

such as cartridges, for use with this package.

Extending from the back of the interface is an edge connector of the type which will be familiar to Pet users. To this you connect a Pet-to-IEEE cable, which Commodore and other manufacturers are able to supply, and you can then connect the computer to any IEEE device you choose, including various types of instrumentation. You can, therefore, use disk drives at their fullest speed and, in addition, you can type the word FAST in order to get the clock rate in your 128 to operate at the fastest possible speed. But this is not quite so attractive as you might at first expect, as the screen now blanks out if you are using a television set rather than a monitor.

The Brainbox device has been made compatible with CP/M so that you can use your IEEE parallel disk drives in CP/M mode. This is significant, as there is a large body of public domain software available for CP/M. Initially this software was not much use to a Commodore user because it wasn't available in a format compatible with Commodore disk drives, but this is changing.

The small switch on the top of the Brainbox unit permits you to switch from 128 to 64 mode of operation. This will please users of both machines, and also users who wish to use 64-type software on their Commodore 128 — this is particularly attractive while the software flow for the 128 is a little sluggish. Users should be careful when buying software for the Commodore 128, as much of the early software is marked 'C128 and C64'. All this is likely to mean is that the software will run on the C128 in Commodore 64 mode, which may not be what you have in mind at all. After all, if you shell out for a 128 rather than a 64, you expect the programs to exploit the improved facilities. Otherwise, why choose to buy a Commodore 128?

Facilities

There are several interesting features of the Brainbox unit which should not go unnoticed. In particular, all print commands, instead of being directed to the serial port to be sent to one of Commodore's rather slow serial printers, are now automatically sent out through the serial port, the IEEE parallel port or the user port, according to which printer the unit finds is connected.

Many suppliers will provide you with a relatively inexpensive cable for connecting your Commodore 128 or 64 to a Centronics parallel-type socket; this will enable you to use the much more common Centronics parallel type of printer. If you need Commodore graphics, you can now choose from the full range of Commodore printers, including the early IEEE parallel ones.

In addition, DOS support has been made available in 64 mode. This is particularly attractive, because it means that you don't have to load up the DOS support program from the utilities disk supplied with your disk drive in order to obtain convenient operation of your disk commands while in 64 mode.

Old-timers who are experienced users of early Pets, Vics or 64s with a disk drive will find the DOS support facility convenient. After all, the idea of convenient disk commands is that they should come into your mind immediately, and should not require you to consult the computer's manual in order to deploy them; nor should loading up a program from disk be necessary.

In use

Using the Brainbox unit is simplicity itself. You plug it in, hook the cable on, insert a cartridge if you need to, and away you go.

An extra and unexpected feature is the ability to use this unit, or rather, several of them, as a cheap networking arrangement. People are deterred from networking due to the expense, and this is particularly true in the education sector. Brainbox has come up with a cheap and effective answer. Plug a Brainbox interface unit into each machine, and link the units by means of a cheap ribbon cable which connects 18 pin headers which can be plugged into the boards of the box. This is not intended to be a 100 per cent safe system for data transfer. However, in the education environment, the vitally important consideration is to connect a large number of computers to a small number of peripherals at the lowest possible cost, so this unit fits the bill admirably.

One of the more interesting design criteria which has been adopted by the designer of the Brainbox interface is that mixing serial and parallel devices is perfectly satisfactory. Some previous IEEE interfaces for Commodore computers have assumed that if you have a parallel device, then you clearly do not also have a serial one as well. This is unreasonable. Users who have bothered to buy a large capacity and expensive twin drive, such as the 8050 or the 8250 Commodore drives, are quite likely to have also bought a single serial drive in order to be able to load programs from one drive and run data disks on another. This will be essential in any case for users of commercial software who may find that the only disks available are not readable by any of the large capacity drives just mentioned.

The history of Commodore disk drives, and indeed Commodore computers, has been interesting to say the least. The key word has been 'incompatibility'. First, there was the 2040 disk drive, which was a twin drive of substantial capacity — 170k on each single-sided, single-density drive. This was quickly followed by the 3040, which was really only a label change and the removal of some software bugs. The 4040 was a further step forward, again achieved by a new set of ROMs for the operating system. The step forward was that the disk drive would now automatically examine a disk as soon as it was inserted into the drive, and read its directory and block allocation map into the RAM of the disk drive. (Each disk drive model which Commodore has manufactured has been an intelligent machine, with the operating system contained in the disk unit itself. This is in some ways an advantage, and in others not. The only way you can upgrade earlier models of the disk drive to the new standards is to buy new ROMs, and these are far from cheap.)

However, having an intelligent drive means that the disk unit is really a computer, and in some circumstances can be instructed to carry out an operation and can then be left to its own devices. It can even be disconnected from the host computer and be happily left doing its own thing. The new facility offered by the 4040 is important, though, as the 2040 and 3040 drives are quite capable of splatting new files all over your old ones, as the block allocation map is not updated when you swap disks. The way to avoid danger is to send an initialisation command to the disk unit immediately after changing disks.

The updated Basic in the 128 contains the DCLEAR command which covers the above situation. However, users of the 64 must type OPEN 1,8,15,"IO" or OPEN, 1,8,15,"I". To non Commodore users, this will no doubt seem strange, but the reason for this quaint procedure is simple. Commodore has not yet produced a drive in which the disk is spinning at all times. Unlike the circumstances which you find when using machines from other manufacturers, when you put a disk into a Commodore machine, the hub does not rotate. This produces two problems: firstly, the disk drive must wait to get to speed before attempting access for reading from or writing to a disk; and secondly, you can't rely on centrifugal force to centre your disk onto the hub.

The first problem is dealt with by the disk operating system, which tells the

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disk unit exactly how long to wait for the motor to get up to a safe, steady operating speed. This waiting period has a safety margin built into it, so a single line of Basic can be used to shorten the delay time on the drives where this is found to be a problem; notably, the 8050 drive can be subjected to this treatment without undue risk.

Fast reactions

It's also possible to speed up the reaction of the disk system by ensuring that the disk continues to spin for a longer period of time than the designers have provided, after any disk access has taken place. This will increase the probability that the disk drive will be spinning when the time arrives for the next read or write operation to take place. The unit 'knows' if the disk is still spinning and commences operations immediately in these circumstances.

I will give you the code for this facility later in the article, but it should be treated with some circumspection. If your disk drive is in perfect condition and is correctly aligned, then cutting down on the safety factors supplied by the designers is probably safe enough. However, don't blame me if your 8050 drive obligingly loses data!

The non-rotating hub is a different matter, as it makes it even more important than usual to insert the disk media carefully — it's even worth moving the disk in its sleeve until it is centred. In addition, the really cautious user will gently lower the drive door into position twice before closing it completely. It's also essential for you to use hub-reinforced disks, as the clamping process can carry out an interesting form of modification to the hub of an unreinforced disk.

This all sounds rather horrendous, but there are benefits. Commodore has arranged that all its disk drives are extremely forgiving in the matter of the quality of media which they demand. If you are cautious in your selection of media manufacturer, you could probably get away with running lower quality disks than the unit is supposed to require.

Another feature of the 4040 drive is the relative record system for direct access (random access) filing. This has made possible database programming with a lot of the hassle removed. Anyone who owns an early drive should upgrade the ROM set to 4040 standard by buying a set of new ROMs — the improvement is well worth it.

The next drive to be produced by Commodore was the 1Mbyte single-sided, quad-density unit, the 8050. This was a breakthrough as far as capacity was concerned, but, to the dismay of users, it was rather slow. If you were to pack 500k of data on one side of a 5¼in disk, you would be working right at the frontier of media reliability. Accordingly, the Commodore designers gave the operating system plenty of scope, with multiple attempts at various disk operations to make up for deficiencies in the media being used.

It was this which gave rise to the one line of Basic which speeds up the operation as previously described. (By the way, for the really wealthy, this little bit of code was encapsulated in a speed-up ROM):

```
OPEN15,8,15
:PRINT#15, "MW"CHR$(0)CHR$(16)
  CHR$(3)
  CHR$(6)CHR$(4)CHR$(250)
:CLOSE15
```

The next Commodore disk drive was the 8250 — this is a real 'humdinger'. Firstly, the capacity is a massive 2Mbytes in two 5¼in drives of quad density; and secondly, the speed improvement brought this unit up to the speed of the 4040. The 8250 is very reliable, and is a must for the serious user who needs a twin drive. The drive must have thrown the manufacturers of diskettes into considerable confusion. Normally, quad-density drives must not be used with disks with hub rings: the clamps locate the media onto a tube which is parallel-sided, rather than the tapering cone of other, lower-density, drives. This is to ensure perfect registration. However, the Commodore drives eschew such refinements: they *should* be used with hub rings.

Users are happy with the 8250 drives, and it isn't necessary for the media to be guaranteed for 100 years. The drives appear to be remarkably tolerant.

The next drive, the 1001, is half an 8250 — that is, it's a 1Mbyte single drive, and this is just as reliable as its larger brother. The 1540 Vic drive and its successor, the 1541, are the causes of much dismay to serious users of Commodore equipment. They are slow, unreliable, prone to breakdown, and are inclined to go out of alignment. This process is aided and abetted by the kind of software protection against piracy which bangs the read-write head against the stop repeatedly, something which the stop was never meant to withstand.

Below is a line of Basic which will eliminate the above problem, and should be typed in before any commercial program which is DOS-protected is used:

```
OPEN1,8,15:PRINT#1,"M-W"+CHR$
  (106)+CHR$(0)+CHR$(1)+CHR$
```

(133):CLOSE1

Compatibility of the reading and writing of various Commodore drives is also interesting. Firstly, the philosophy is read-compatibility where possible, but not write-compatibility. Therefore, the 4040 reads a disk which has been formatted on a 3040, but if you attempt to write to the disk, you'll have problems reading the data later.

Similarly, 8050 disks can be read by an 8250, but it's risky to write to them. In addition, an 8050 will read the bottom surface of an 8250 or 1001 disk, but not the top. Therefore, you must be sure that the 8250 or 1001 disks are only half full if you wish to make them readable on the 8050.

In trying to read an 8050 disk, an 8250 or 1001 drive will go into error condition on the first reading attempt, but after that, all subsequent reads will be satisfactory. Alternatively, you can make your 8250 'think' it's an 8050. Here is the relevant code:

```
OPEN 15,8,15:
PRINT#15,"M-W+CHR$(172)+
  CHR$(16)+CHR$(1)+CHR$(1):
PRINT#15,"M-
  W"+CHR$(16)+CHR$(1)+CHR$(0):
  PRINT#15,"U9":CLOSE15
```

If you want to use serial and parallel disks together, you should ensure that they have different device numbers. Curiously enough, the Brainbox interface manual does not tell you how to change this in software: it invites you to contact your dealer.

I would have thought that publishing the following line of Basic would have been a lot simpler. For changing device 8 to device 9:

```
OPEN15,8,15,"M-W" CHR$(12)+
  CHR$(00)+CHR$(2)+CHR$(41)+
  CHR$(73):CLOSE15
```

In addition to operating with other cartridges, Brainbox's interface is unique in being totally compatible with the Simon's Basic cartridge.

Documentation

A 27-page booklet accompanies the unit, which contains not only the usual information which you would expect, but also a certain amount that you would not. For example, there's some machine language source code for auto-starting 64 programs and 128 cartridge software. In addition, there's a considerable amount of information which is needed by machine code programmers, which covers exactly how the unit works and how with such code programmers can make their programs interface with the unit.

I found absolutely no difficulties in using the Brainbox interface unit, which transforms the Commodore 128 and the 64 into really rapidly-operating machines. The unit is highly recommended, particularly to anyone who already owns one of the faster disk drives and wants to get the best out of their Commodore 128 or 64.

The Commodore 64/128 IEEE 488 interface is available from Computer Business Aids, 61 Aerodrome Road, Maroochydore Qld 4558. Tel: (071) 43 5551.

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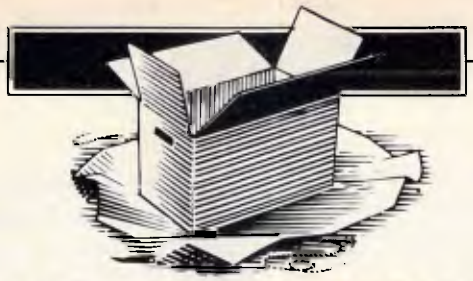


WHAT'S NEW

Ian Davies checks out the most interesting new micro products announced over the last month.

Microcomputers

Intel 80386 takes off

Already, the 80386 based machines are starting to hit the streets, and believe me, they're going to make quite an impact.

The 80386, for those of you who don't know, is a supermini computer on a chip. It can address up to 4,000Mb of real memory and 64,000,000Mb of virtual memory through an on-chip demand paging system. To top it all off, the little brute runs at around 4 Mips — around three times the power of a VAX 11/780. Naturally, it includes all those bits and pieces you need in a multi-user situations. And what multi-user operating system is the multi-vendor standard? Unix.

This all becomes particularly interesting. On the one hand, we have Intel warning that it's going to take over in the computer systems market. On the other hand, we have Microsoft with its highly successful but architecturally constrained MS-DOS, and we also have UNIX, which stands to be a success even if only by the weight of numbers. Now we all know that Microsoft is getting its act together with a multi-tasking and/or multi-user operating system, and we all know that the insides of MS-DOS started looking more like UNIX and less like CP/M starting with version 2.0.

The interesting bit is that Intel has signed an agreement with Microsoft whereby Intels version of UNIX, called V/386 will now be compatible with XENIX. It all starts to take shape . . .

Of course, there is still the speculation (terror) that IBM will come out with their own proprietary operating system, and that may louse up everybody's plans. But somehow it seems more likely that IBMs 80386 machine, when it appears within the next six months, may be sporting a UNIX derivative.

More information is available from Total Electronics, on (03) 288 4044.

Philips enters clone market

Philips has jumped on the band wagon with the introduction of two IBM clone microcomputers.

The 3100PC is a dead ringer for a humble IBM PC, running an 8088 processor at 4.77Mhz, coming with 512k RAM as standard and four expansion slots. The 3200PC is the same thing, but AT flavoured. It runs an 80286 processor at 6Mhz, again with 512k RAM as standard, but also with a 28msec 25Mb hard disk.

These machines are quite distinctive, as they enter the market providing only the same level of performance as the IBM offerings. These days, everyone else is running 8Mhz 8086s and 10Mhz 80286s or 80386s, and still having trouble selling.

No doubt the Philips machine will do well, it's just that they seem to be a little late, and a little behind the eight ball. More information on (02) 888 8222.

Orchid Turbo 286e

Porchester Computers has announced the availability of the PCTurbo 286e board from Orchid.

This board comes standard with 1Mbyte of RAM, an 80286 processor running at 8Mhz with no wait states and software for disk caching, print spooling and a RAM disk. A socket is provided for an 80287 numeric co-processor running at either 5 or 8Mhz. A software utility can either switch the board to full speed, or run it at a leisurely XT pace.

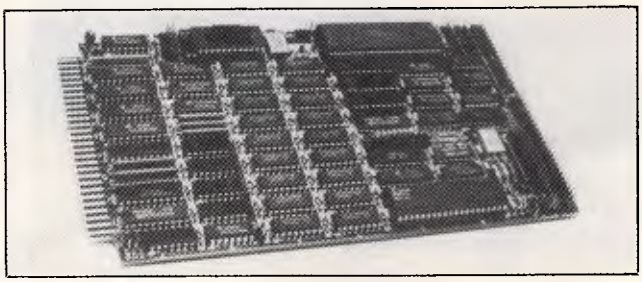
Based on the Norton Utilities benchmark, the PCTurbo scores 9.2 against the IBM AT's 5.7. The Norton figures are notoriously unrepresentative of everyday use, however several other business-like tests consistently show a humble XT equipped with the PCTurbo outrunning at AT by a factor of two.

The Orchid PCTurbo sells for a recommended $2,100. You can call Porchester on (03) 537 2722.

Single Board Computer

A Z80 based standalone computer on a board has gone through a recent enhancement.

The Micromaster computer features a Hitachi HD64180 Z80 compatible microprocessor, two RS-232C ports, printer port, FDC and S-100 bus stan-



dard connector. Up to 512k RAM can be installed on the board. Dual DMA channels, a memory management unit and two counter/timers are also included.

A single user CP/M compatible operating system, called Z-System, is also available. This allows normal CP/M software to be run on the board, as well as providing many extra facilities.

More information is available from Microtrix on (03) 439 5155.

Software

Entre' the POS system

Entre Business Centres has introduced a new point of sale (POS) system aimed at small to medium retail businesses. The system involves integrated hardware and software developed by Sanyo.

The system can support from 1 to 99 cash registers either in local or remote locations. Pricing for up to 10,000 products can be held, and the system can perform sales analysis, inventory history and account enquiries. The cash registers can store data for up to 72 hours during power failures.

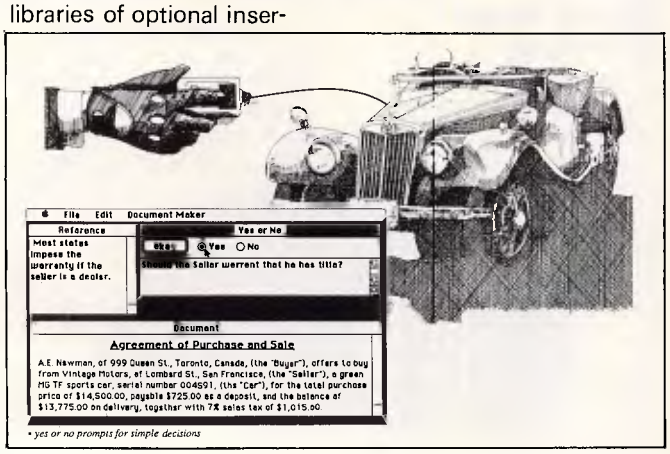
This system is Entre's first foray into vertical markets. More information is available on (03) 529 7599.

Knowledge Modeler

InfoMagi has announced the availability of the Model Office Company range of productivity packages. This software, initially available only for the Macintosh, is specifically designed for the 'knowledge worker'.

The two main products, Document Modeler and Project Modeler, are based around the idea of not reinventing the wheel every time you want to do something. In Document Modeler, model documents can be created in which the general format and layout are fixed, as are certain introductions and paragraphs. Added to this are libraries of optional insertions. When a document needs to be created, the user is presented with a series of menus and, if necessary, asked questions to determine the detailed contents. The document can then either be printed directly, or saved to disk. This allows managers to provide detailed guidelines for secretaries, or save work for themselves where many documents are similar.

Project modeler is a similar idea, but for project management. IBM PC versions of these products are expected to be available soon. More information is available on (02) 858 4111.



* yes or no prompts for simple decisions

Atari & Amiga Videotex Packages

With the continuing boons of Telecom Viatel, Paris Radio Electronics is distributing videotex emulators for both the Atari 520ST and Commodore Amiga Computers.

The Supertex packages both sell for $89.95, and include full graphics and colour support of the videotex terminal standard. Additionally, Hayes compatible modems can be driven directly, with no hardware baud rate converter required. Functions keys can be defined, and pages can be saved to disk.

Paris Radio Electronics is on (02) 344 9111.

SMART Network

Sourcware has launched a special networking version of the SMART integrated software system.

The SMART package includes a word processor, spelling checker, data manager, spreadsheet and graphics system. The multi-user aspect is on a module basis, with users being allowed or disallowed access to the various components of the software as required. Sourceware says that integrated software can take more advantage of shared resources across a network.

SMART is compatible with all MS-DOS 3.10 compatible networks, including Novell, 3Com 3+ and the IBM PC network. Upgrades for existing SMART users are available.

More information is available from Sourceware on (02) 411 5711.

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The Epson PC+ also boasts the technical pluses its name implies. Like double the processing speed, a standard 640K RAM and five expansion slots making it ideal for networking.

There's a dual speed microprocessor, precision keyboard and options including a 20Mbyte hard disk and a 1.2 Mbyte floppy disk drive.

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World-Class MUG off to flying start

The Atlantis International Great Galactic Conflict, the Viatel based multi-user game hoping to make it into the Guiness Book of Records, has got off to a flying start.

The G.G.C. is being run by Microtex 666, Telecoms largest service provider on Viatel, and is sponsored by Atlantis International. The G.G.C. is a game of strategy and negotiation, where players choose their own pseudonyms and communicate anonymously with each other via the Microtex game computer. The G.G.C. software, designed and created entirely within Australia, allows for up to 1,000 players to interact simultaneously.

The first game started with two test moves, in which players could achieve a familiarity with the system and rules. All players were then reset to their starting positions for the game to commence in earnest. Initial popularity of the G.G.C. is very high, with user demands placing strains on both the Viatel and Microtex computers.

The first G.G.C. game will last for eight weeks. We'll keep you posted.

Peripherals

Letter Quality Puck

One of the most interesting ideas to show up for some time must be the Metatext printer interface by Image Computer Systems.

The product consists of some resident software which takes over the printer interrupt in an IBM or compatible BIOS, converting all characters to bit image graphics which etch out near letter quality characters on an Epson or compatible printer. Six fonts are provided, and the printer can also be driven in its normal character mode.

The neat idea, however, is the puck which sits on the desk, and is simply flipped over to select between draft and NLQ modes. The puck plugs in with a pass-through connector, sitting between the computers parallel output and the printer cable. As well as being a high quality user interface, the puck also makes an effective and convenient form of copy protection.

Metatext is available from Jenton Software, on (02) 666 3348.

Relational Database Server

Squirrel Systems has announced the availability of the Britton Lee Relational Server machine, the RS310. This machine acts like a file server for a LAN, except the box runs a relational SQL based DBMS, and the machines in the network make data access requests through the RS310. The idea is that better performance can be achieved through specialised hardware and software designed specifically for data management.

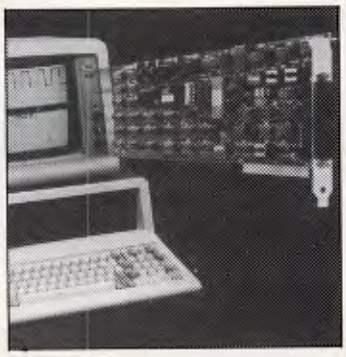
The RS310 comes with 1Mb RAM, 86Mb of hard disk storage and a 60Mb tape backup system. Disk storage is expandable to 172Mb. The unit can be interfaced via Ethernet to MS-DOS, UNIX and VAX/VMS machines. Benchmarks have shown the Britton Lee box to outperform traditional software-only approaches by as much as 20 times.

This sort of thing is going to become more common and more necessary as time goes on, and is the logical evolutionary cul-de-sac for mainframes to find themselves in. Keep watching.

Incidentally, Squirrel also has a software product for MS-DOS machines called Gigafile, which allows the DOS 32Mb per volume limit to be avoided. Using Gigafile, as much as 1,000Mb may be stored on a single MS-DOS volume. More information is available from Squirrel Systems on (07) 891 5600.

High Speed ADC

Novatech Controls has released a high speed analogue to digital converter board for IBM PCs and compatibles. The DASH-16F provides 16 analogue single ended inputs, or 8 differential inputs which are converted into a 12 bit digital output. The board can support sampling rates of up to 100,000 samples per second. Transfer from the board to system RAM is performed using DMA.



The board comes complete with an example assembler driver routine,as well as calibration software. Drivers for Fortran, C and Turbo Pascal are available at an additional cost. The board sells for $2,520, and is available from Novatech on (03) 645 2377.

Laser Modem

Scitec Communication Systems has introduced a laser based modem. The Interlaser system provides full duplex communications at rates of up to 2Mbps, over distances of up to 2kms. The modem can, of course, only handle 'line of sight' communications, but for many applications, this would be no limitation at all. Making a once off investment in optical transmission can save the recurring costs of leased lines, or the much higher cost of laying cables.

A single Laser-Inyx can handle data, voice, and video conferencing simultaneously.

More information is available from Scitec on (02) 428 9555.

Sigma Laser Printer

Sigma Data now distributes a laser printing system called the Printellect, manufactured by the US company Kidron.

The printer comes complete with pop-up menu

apricot

The press verdict...

APRICOT XEN-i

WHICH COMPUTER?

"The XEN-i has to rank as one of the fastest AT-compatible computers we have ever tested...

The design and small desktop footprint of the machine are a definite advance on the bog standard AT clone and really show the British company's interest in innovation...

The XEN-i keyboard is nicer than many we've come across... We applaud Apricot for offerring a choice between its keyboard and plug-compatible IBM clones"

PRACTICAL COMPUTING

"A classy machine which provides extra dimensions to the AT standard.

The XEN-i takes over pole position as the fastest AT emulator around. By fitting the LIM Expanded Memory Specification as standard, Apricot shows it has an eye to the future."

[UH]

"We found the XEN-i to be an attractive machine which is easy to use. It is powerful, well designed and fast, as well as value for money.

The XEN-i is an impressive machine. It is faster and more powerful that the AT. It looks better, comes with more software and can work on the same networks and micro-mainframe links as IBM's machine."

WHAT MICRO?

"The XEN-i is easily the fastest IBM Compatible What Micro? has ever tested.

The XEN-i is an excellent product, possibly the best AT compatible on the market... The XEN-i emerges offering a specification that few other systems can equal..."

PC USER

"An impressively fast IBM-AT compatible workhorse which will give Apricot entry into corporate computing and put the Apricot back on the executive desk."

XEN MULTI-USER

WHICH COMPUTER?

"We were relatively impressed with the hardware and 10- net networking software it used. We tried running a number of packages... and they worked without significant problems.

With all that local processing power, speed was very respectable indeed.

The XEN multi-user system seems an attractive and flexible option."

	Software support	Terminal flexibility	Speed	System	Value for money
Apricot XEN	4	4	4	4	4
NorthStar	4	4	3	4	4
Olivetti M28	3	3	4	4	3.5
Pinnacle	3	3	4	3	3
ICL DRS300	3	3	3	3	3

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software which can be used within other software products for font selection, sizing and scaling. A number of packages are specially supported to allow comprehensive text formatting, and output from these packages can be merged with Kidron's own graphics system.

For greater cost effectiveness, the printer can be connected to 8 computers, with one line allocated priority.

Overseas

New AT&T Fabrication Plant

AT&T has commenced construction of a new microchip development and production facility at its Pennsylvania plant. One of the main uses for the new plant will be chips involving gallium arsenide technology, a faster alternative to silicon, but far harder to fabricate.

The 10,000 square feet factory uses an ultraclean environment, similar to that used for megabit memory chips. The air in the actual wafer production area will contain about one dust particle per cubic foot. By way of comparison, a hospital operating theatre contains around 100,000 particles per cubic foot. To maintain these high standards of purity, each clean room is broken into five environmentally separate modules, and where possible, equipment is installed outside the room with just the control panel on the inside.

In addition to GaAs technology, AT&T also plan to produce on a large scale SDHT (selectively doped heterostructure transistor) and E/D (enhancement/depletion) chips. All of this technolgy is in the quest for speed and, until now, has presented enormous manufacturing problems. AT&T plans that the new facilities will be as automated as possible, thereby increasing yield and maintaining quality control.

Kurzweil Strikes Again

Kurzweil, the company infamous for taking problems everyone else had thrown in tomorrow's 'too hard basket' and solving them today, has done it again.

Kurzweil is probably best known for its reading machine, released around five years ago and capable of reading a normal book to a blind person. This machine was able to handle all the complexities the researchers found so tricky, including marginal print quality and varying fonts.

This time, Kurzweil has produced the KVT Voice-terminal. This is an ASCII or 3270 terminal, which can also be an IBM compatible PC and is driven using voice input. The KVT can handle a 1000 word or phrase vocabulary, and various vocabularies can be set up for different applications. This technology has application, not only in the field of the disabled, but also in industry where 'hands-off' control is required.

Everyone knows that IBM is working on its own voice actuated typewriter, and it looks as though Kurzweil may have stolen line honours yet again. However, in an uncharacteristic cop-out for Kurzweil, the system does have to be 'trained' for individual voices. But you can bet the same will be true of the IBM system, when it arrives. The Kurzweil KVT costs around the $US10,000 mark.

Philips WORM Drive

Following on from the original CD-ROM concept for laser disks, Philips in the US is working on its own CD-PROM, also known as a WORM drive (Write Once, Read Many).

Although several other manufacturers are already producing WORMs, these tend to sacrifice capacity for the ability to write, often only storing 20 per cent to 40 per cent of a read only drive. The Philips device is expected not only to be available in CD-ROM size, but also provide CD-ROM capacity, that is, 540 Megabytes. The only catch is that the Philips unit will store its bits as phase changes in the media, instead of tiny pits. This means that the CD-PROM format will be incompatible with the CD-ROM format.

Philips, however, expects to be able to produce a single unit which can handle both CD-ROM and CD-PROM formats. The other drawback is that the CD-PROM will be more fragile, similar to today's 3.5in floppy disks.

The CD-PROM is expected to be marketable within the year, and should sell for around $US1,000.

Biological Computers

I don't mind admitting that I live every day in quivering fear that genetic engineering will displace computing as the number one sunrise technology. Truly, the biological sciences are going through a renaissance era at the moment which the world hasn't seen since the micro boom of the 70s.

From the 'it had to happen' department (just next to the 'I think our jobs are safe, after all' section), researchers at the Carnegie-Mellon University in Pittsburgh have *succeeded* in building prototype computer circuits from biological material.

Two devices are being pursued, a simple memory circuit and a NAND gate circuit. From NAND gates, it is possible to create any other logic circuit. In fact, you can build an entire computer system from NAND gates. Currently, only the memory circuit has been prototyped, utilising laser activated bacteriorhodopsin proteins. The results are amazing. Only three molecules are required to store one bit, resulting in a storage density on the prototype of 1 gigabyte per square centimetre, and a projected maximum density of 100,000 gigabytes per square centimetre. Access time is 10 picoseconds. The NAND gate, although not yet prototyped, is expected to be as fast as 3 picoseconds, and 100 times smaller than current technology can produce in the foreseeable future.

Not surprisingly, Seagate Technology, the disk people, are very interested in applying this technlogy in the market.

New 20 Mip RISC Chip

Engineers at the Stanford University have designed a microprocessor which they expect will be able to run at 20 million instructions per second. The chip, based on RISC technology, has not yet been fabricated, but is expected to hit the silicon some time this year.

The MIPS-X is rated at a peak processing speed of 20 Mips, but Stanford expects that a more realistic average throughput will be 10 to 12 Mips, still much faster than many multi-million dollar IBM mainframes.

Surprisingly, Stanford does not plan to interconnect several MIPS-X devices together in a so called 'Hyper-cube'. It will leave that problem to someone else. END

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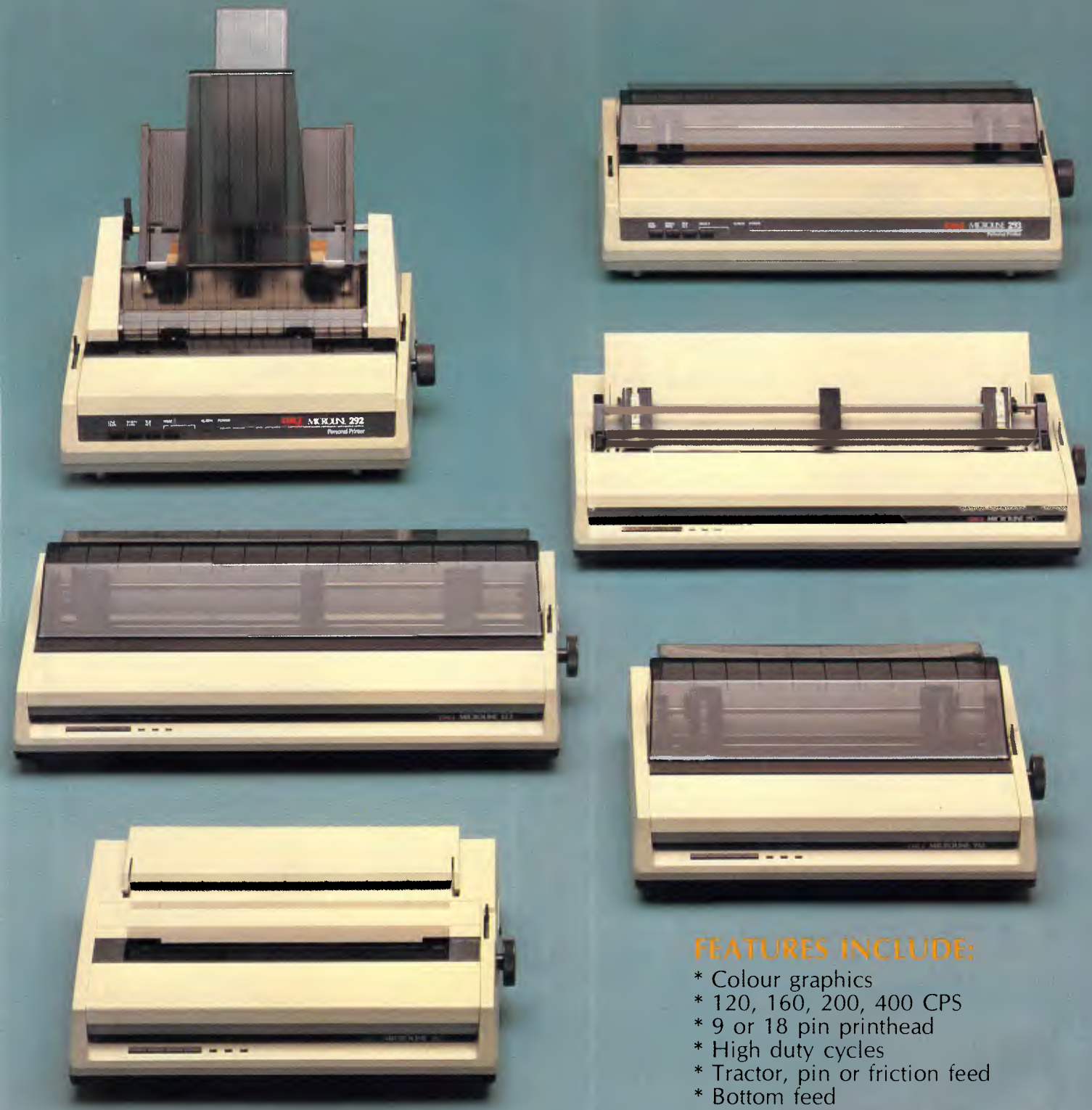

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10456

At last — the perfect guide to the understanding of computers rears its head. David Taylor finds the answers to all his questions in this month's book selection.

Absolute beginners

This may shock you, but there are countless people running about loose out there who don't know the first thing about computers. Many such wretched unfortunates may be pin-sharp in their chosen fields, but have failed to find either the time or the inclination to bone up on the wizardry of chips and their awesome implications. I dare say that millions have begun to sense that they may now be stumbling along on borrowed time, and wish they could lay their hands on a cogent introduction to what's been going on while they were otherwise occupied.

It is on these dummies' behalf that beginners' guides to computing are published at roughly five-minute intervals. As a rule they're pretty awful, either tending to patronise or to philosophise, sometimes both. Gee-whiz Americans are often the worst offenders, with painstaking instructions on how to put a plug into a socket, then rambling asides on the nature of existence, with a side relish of incomprehensible jargon. Only now and again do we get a lucid and engagingly written account of where computers come from, what they can do and how they go about doing it, plus what it's likely to lead to — in a nutshell.

This is one such occasion: Richard Stevens' book is an excellent introduction to computers for everyone. He charts the history of the things from theory, through development, to realisation, all with commendable precision and a highly readable style. Mr Stevens (who, by the way, is the head of Information Systems at the European Space Agency in Holland) takes the hardware to bits on our behalf and summarises the principles of programming languages better than I've seen it done in ages, adding a racy guide to commercial software and a short squint into the future of AI. Neither his pace nor your interest slackens, despite such comprehensive terms of reference, and the book's general presentation, illustrations and density are extremely good besides.

Regular readers of this column may appreciate my reluctance to gush, but this is quite the best all-purpose primer I've read, and, God knows, I've read a lot.

Title: Understanding Computers:
A User-Friendly Guide
Author: Richard Stevens
Publisher: Oxford University Press
Price: $46

Chartist's materials

They're a very nice series, these glossy paperbacks from Microsoft, expanding on MS-DOS or Word or what have you. Funnily enough, Microsoft Chart is what we have here for one-time Washington locksmith Steve Lambert to fiddle with and thus reveal columns, bars, lines, pies, scatters, and so forth, the way impact-made boardrooms like 'em.

I'm sorry to bring on the wet blanket again, but if gee-whiz presentational graphics are what you need, the otherwise inestimable IBM PC just isn't the first machine to spring to mind, as arty-smarty it's not.

If you'd stop fiddling about with Pascal on that Mac, you'd find that machine does a nifty job at drawing what you will. IBMs can do better if you're talking AT with an enhanced colour card and the new sooper-dooper monitor, and so on, but the bog-standard PC is no Leonardo, or Hercules wouldn't be in business.

Still, Chart is nothing if not a triumph of ingenuity, and while I'd hesitate to endorse Mr Lambert's promise of 'dazzling' presentational graphics, they'll do. Precisely what they'll do, of course, depends on what you want to put across. 'A graph is an editorialised comment,' asserts Mr Lambert, as corporate Americans tend to do. 'It is weighted heavily by your opinion or point of view.

The first step towards creating an effective graph is deciding precisely what point you would like to prove or which elusive fact you would like to force out . . .'

Quite so and elementary again. With this book you are taught how Chart does charts *ad nauseam,* rather as you were when reading Chart's in-box documentation, and then you're tempted half-crazy by a series of demonstrations of how much better it's done using pricey peripherals like Laserwriters.

Chart is now hugely popular in the US. I'm impressed, even though I don't have much use for it.

The latest Microsoft product I'm bursting to try is Word Version 3.0, which apparently does everything any author could ask, except make the tea, and is, I gather (and fervently hope) at last rid of the original protection system which was such a bind if you wanted to reinstate Word after doing reckless tasks such as reformatting an overcrowded hard disk. I trust Mr Lambert will provide another glossy add-on handbook in due course.

Title: Presentation Graphics on the IBM PC
Author: Steve Lambert
Publisher: Microsoft Press/Penguin
Price: $39.95

Look, no soldiers

Not for the faint-hearted, this. I wonder that Frank Barnaby isn't a martyr to nightmares, since he's preoccupied (as in a couple of previous glum books) with the prospects, such as they are, for world peace and stability. The short answer is that they're not at all good, because of the terrifying lick at which ever-deadlier weaponry is turned out. Yet they just might get better. Mr Barnaby has a plan.

Computers, he points out, are now forcing the pace of armaments development at mind-boggling speed — automating this, revolutionising that. It's ingenious and marvellous, up to a point. But it's also a bizarre, chilling future he predicts, as computerised, 'hands-off' warfare looms.

Frank Barnaby is by training a nuclear physicist, who for 16 years worked on research into nuclear weapons. He was not encouraged by what was going on, so he switched his attentions to 'peacemongering' — as director of a Scandinavian Peace Research Institute, then as a lecturer pottering about the world as a kind of travelling academic evangelist for world disarmament.

What particularly exercises him is that computerised systems on 'conventional' weapons are now making them so accurate and so destructive that the gap is closing between 'contained' and full-scale nuclear war, thus upsetting the strategic applecart.

What's more, as battlefields get more and more lethal, no soldiers will be able to survive and the use of robotics and unmanned weapons will increase, ultimately to the point where commanders may direct operations from remote command posts, watching on their VDUs as automatic ironmongery slogs it out to armageddon.

It's a surreal prospect, but one for which Mr Barnaby already sees advance signs. Missiles look after themselves once launched. Already, many reconnaissance and target-acquisition operations are handled automatically. And as military computers become rapidly more intelligent' there's less and less point in trying to outsmart them with manned intervention of any sort.

So far, so dispiriting; but at last comes Mr Barnaby's master plan. Supposing a 'defence zone' were to be set up on the East-West (German) border, saturated with sophisticated sensors and fancy radar, backed up by satellites. Supposing it were mined, too, and spiked with short-range missiles, so that nothing could get by undetected, nothing could outwit the computerised HQ, ever-ready to deploy just as much or as little as was needed to contain any threat . . .

'Non-provocative defence', Mr Barnaby calls it, since the 'defence zone' would have no relevance for attack. We wouldn't need today's 'conventional' forces — soldiers and their artillery; still less would we need a nuclear arsenal.

It's a pity Mr Barnaby can't be co-opted onto the SALT team. God only knows which way war-mongering will develop in the short-term (never mind the long-term), but Mr Barnaby can sound pretty convincing when he says weapons (and especially small weapons) are changing so fast that they are poised to make nonsense of NATO strategy *soon.*

If there's a crumb of comfort to be seized at, it is perhaps that the unstoppable march of military computers seems to favour defensive rather than offensive strategies.

To that extent, Mr Barnaby's stimulating crusade is a bit encouraging. In today's climate of world tension, it's perhaps not much, but I dare say it's the best we can hope for.

Sweet dreams.

Title: The Automated Battlefield
Author: Frank Barnaby
Publisher: Sidgwick & Jackson/ Macmillan
Price: $35

MacNutter

As you were. No need to worry about a thing, not now the Mac is everywhere. Why, it can do most *anything.* If you need the world or your life fixed, just reach for the handy mouse and away we go. All MacUsers tend to go a bit starry-eyed at the wonder of it all. Vera Birkenbihl goes bananas.

'Suppose you were writing a piece about zebras,' teases one typical chapter.

Righty-ho, Vera. I'm supposing.

'Suppose you wanted to explain the difference between the face a zebra will make when it's seeking contact and the face communicating the "request" to have its skin cleaned.'

Between you and me, there's not a lot of call for that kind of piece, but let's humour Vera for a bit.

'I hope you agree that it would be silly to try to describe these faces with a lot of words.'

Certainly. Wouldn't attempt it, myself.

'Of course, you might think of using a photograph! But suppose that you have only a fuzzy one or none at all?'

I'd be up the creek, Vera, and no mistake.

'If you were able to work MacPaint, you could easily include a drawing.'

See what I mean? Your problems solved. Clickety-click and you've got zebras pulling faces all tickety-boo.

Dear God, this is a peculiar book. Vera has us walking little elephants round a drum-type kinematikon or zoetrope. We get a crash course in Arabic. We're told that if we were to pour a glass of water from a plane, high up over North America, and we could magically change each water molecule into a grain of sand, the whole of North America would be 27 metres deep in sand. Let's take a break and draw a kangaroo.

Vera Birkenbihl runs Brain Friendly Procedures in West Germany. With the help of a Mac, she says, "You can conquer the domain formerly possessed by very few specially gifted people." And the main message of her book: 'MACing something rather than "making" it . . . the key to shifting into higher gear (mentally), thus MACnifying your inherent capabilities and increasing your intellectual potential.'

Of course, Vera. Of course.

Title: MacThink! Increasing Intelligence and Creativity with the Macintosh Computer
Author: Vera F Birkenbihl
Publisher: Sigma/Jacaranda Wiley
Price: $35.85

END

Amiga's incredible graphics

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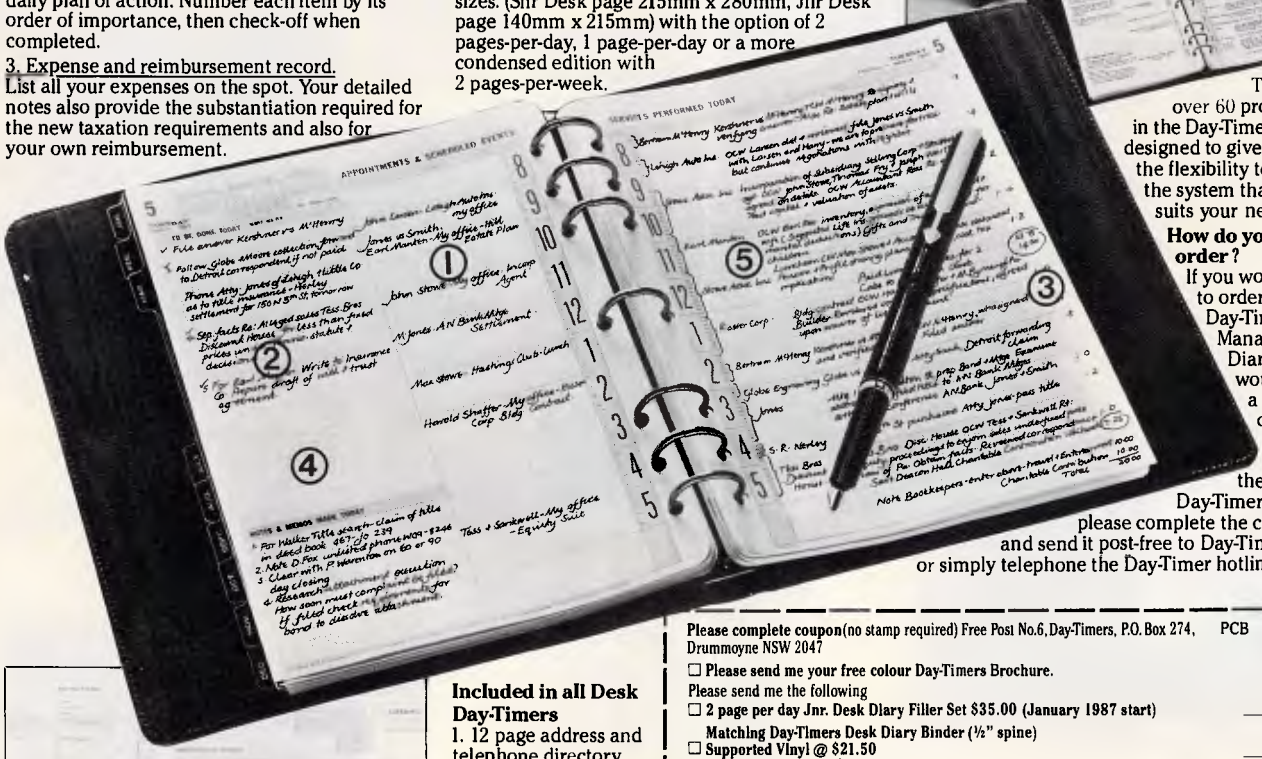

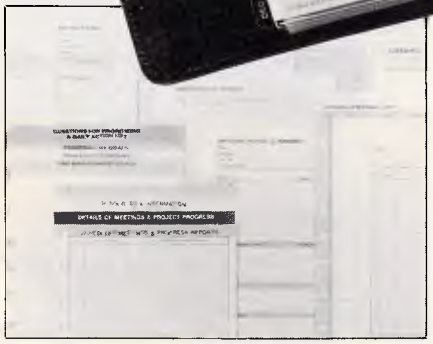

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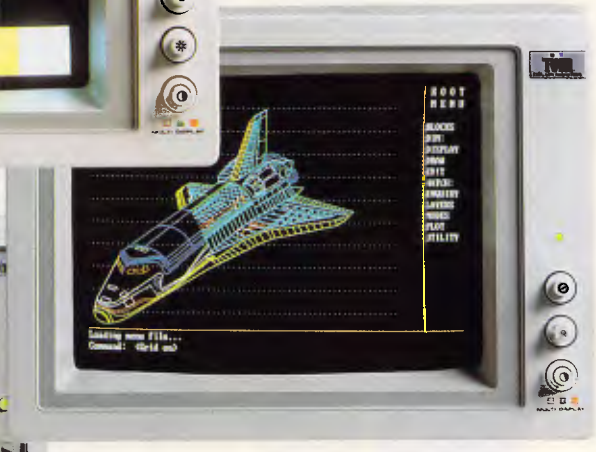

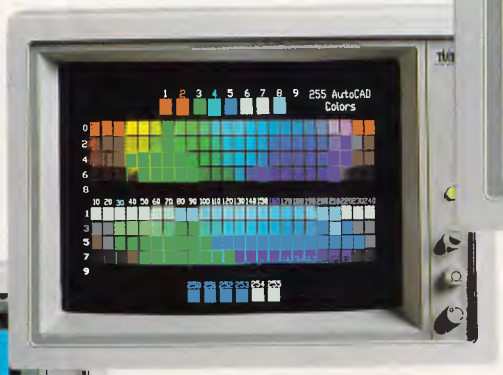

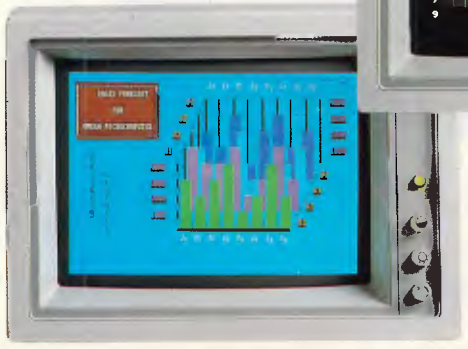

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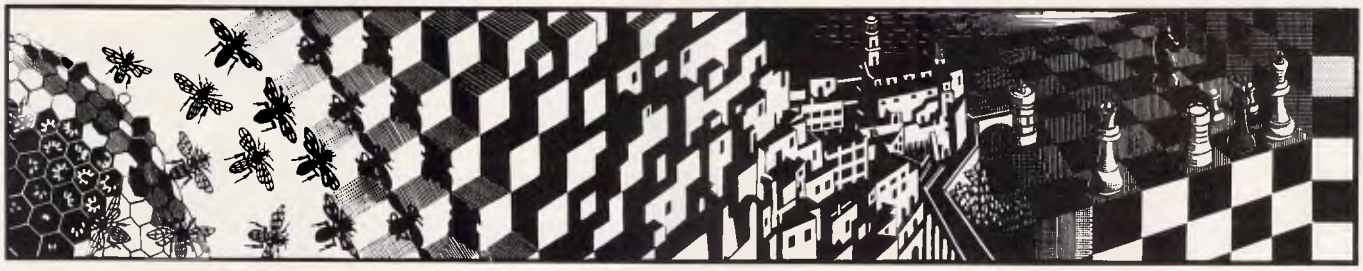

This month's Screenplay has Stephen Applebaum in a fast-action, shoot-'em-up maze game with a difference, and finds himself at a strange circus with even stranger happenings.

Time and time again

Title: Time Bandit
Computer: Atari 520/1040ST
Supplier: Paris Radio Electronics
Price: $71.95

Good arcade games are few and far between these days, which is why none have graced these hallowed pages in months. The problem is that nearly everything I receive in the way of arcade games is a derivative of something that appeared on the scene two or three years ago. For instance, just before writing this month's 'Screenplay', a new copy of Space Invaders staggered onto my desk. There, on my desk, was an anachronism, an echo of the past. I frantically rummaged for a newspaper. Was it April 1st again, already?

Having reconciled myself to never having to review another arcade game, my cynicism took a battering with the arrival of Time Bandit. Not only is this game unique in its structure, it also contains some of the best graphics ever to grace a computer screen in the *APC* office.

In some respects, Time Bandit is reminiscent of Activision's arcade classic, Gauntlet. Time Bandit isn't quite on a par with the latter graphically, but it comes pretty damn close.

Time Bandit is a zap-'em maze game with a difference. As well as the usual shoot-outs, there are complex puzzles and riddles that must be solved to complete the game. To play Time Bandit, you need sharp wits as well as keenly-honed reflexes. Adventure addicts aren't left out either, as there are some intriguing problems that can only be surmounted by finding and using specific objects.

In Time Bandit, you take the part of a treasure hunter who travels through time in search of gold, gems, money and adventure. For the most part, this is accomplished by wandering around a series of extremely well-drawn mazes, or time zones, filching valuables as you go.

Time Bandit's main screen is a map representing the topography of an alien landscape. Liberally scattered about the map are small symbols representing a factory, a sphinx, a Pac-Man and even the Starship Enterprise — to which the game's authors have paid homage — to name but a few. These curious items are Timegates. When you move your character over any one of these, you are flung headlong into a curious and extremely dangerous world.

By walking through a Timegate, you immune yourself in the new world until finding the key, or keys, which will effect your release.Immediately after you enter a time zone, you are set upon by the blood-thirsty Evil Guardians, creatures who protect their land's wealth.

Points, in Time Bandit, are called Cubits. These are earned by finding the keys, unlocking the doors that lead to the way out, gathering treasure and, of course, shooting the Evil Guardians. The number of Cubits awarded to you for shooting an alien depends on your Manner, or bravery rating. I don't know to what extreme this goes, but I was termed 'psychotic' after despatching a host of the evil hordes. The more dangerous you are, the more likely you are to gain the 1000 Cubits necessary to procure yourself an extra life.

Each time zone has its own dangers, whether they're green men with clubs, lions, snakes, spiders, strange bug-eyed creatures, or any one of a multitude of other beasties. What each world does have in common with its neighbours, though, is layout.

Every land, and there are quite a few, consists of 16 levels: four major phases (1 to 4), each with four sub-levels (A to D). The object is to reach the sixteenth level in each world and steal all the Great Artefacts therein. What happens next is a mystery.

Time Bandit is mostly a fast-action shoot-'em-up. However, the inclusion of some adventure sequences makes it something of an oddity.

Just as in a normal adventure, you have to complete Time Bandit's phases by typing in your commands. Most of the puzzles are quite difficult, and many apply to things which happen later in the game. These sequences, therefore, provide a well-earned break for both you and your joystick, as well as useful hints for overcoming contingencies.

Earlier, I stated that Time Bandit features a Pac-Man Timegate. Somewhat cheekily, Bill Dunlevy and Harry Lafnear, Time Bandit's authors, have included a thinly-disguised copy of this arcade classic as one of the worlds that must be conquered. Although it doesn't use the original Pac-Man character, it

plays in the same way but with small, animated men.

Originality and great artwork go hand in hand in Time Bandit. From the weird alien landscapes to the multifarious hordes, the amount of detail is incredible: ghosts rise from graves, then turn into Ghostbuster symbols when shot; bouncing balls poke out their tongues in wide-eyed surprise; bombs say either 'dud' or 'pow' when hit; and small, green men scamper about, manically cleaving the air with their clubs. Only lions, which walk sideways like hippy crabs, let the side down.

One of Time Bandit's most exciting features is that it can be experienced by two players simultaneously. Both players have the same objective, and can either help or hinder the other. The first one to die returns as a shadow. In this state he can shoot anything that moves, including the other player, and steal treasure. He cannot gain points for any of this, however.

Overall, Time Bandit is a marvellous treat for the eyes and ears, and is a blessing for anyone bored with the normal kind of maze game.

Freak show

Title: Ballyhoo
Computer: Commodore 64, IBM PC, Apple
Supplier: Imagineering
Price: $79.94 (C64), $85 (Apple), $90 (IBM)

Click! The spotlights are switched off and the band gently winds down the refrain. The purling crowd rises, and slowly shuffles towards the moonlit exit to reality. Only the scrunch of sweet-wrappers and popcorn cartons breaks the reverential silence of the awe-struck children. But that's allowed. It's all part of the atmosphere, part of the circus fantasy.

But what happens when the laggards have finally left the lot, and the clowns have removed the greasepaint and the other meretricious trappings of their trade? Do they live like the rest of us, or by another, more ancient, Romany code? What would it be like to linger, observe, and become part of the show? Could you survive?

If the challenge of the circus sounds exciting, Ballyhoo, Infocom's latest adventure, could be for you. Set in and around the failing Circus That Time Forgot, Ballyhoo is a fantastic amateur detective story centred on the sinister happenings among the circus' remarkable employees.

Curiosity running wild, you remain after an evening performance to try and find out what really goes on behind the fixed smiles and affected laughter. Sadly, reality seems to have shattered the fantasy, as, overhearing a conversation, you discover that the circus owner's daughter, Chelsea, has been kidnapped, and an inept gumshoe has been hired to find her abductor.

Munrab, Chelsea's father, believes the work to be that of an outsider, and fails to see that the most likely perpetrator is one of his own performers. Knowing that the detective will fail unless he asks questions inside, rather than outside, the circus, you set off to find Chelsea yourself.

However, as interlopers aren't taken to kindly by the close-knit circus community, you have to somehow persuade people that you, too, are a performer, and not a nosey outsider intent on incriminating one of their 'family'.

Newcomers to adventures would normally take heart from knowing that Ballyhoo is categorised as being standard, which means it should be fairly easy. I found it difficult, though, and several fruitless hours' play led me to believe that I'd never solve the problem of who kidnapped Chelsea, what his or her motives were, and where she is now hidden. I didn't even convince any of the circus' inhabitants that I was one of their kind.

What I did find were a lot of seemingly superficial items, most of which appeared useless in the light of the problems I faced. My first find was a clown mask which I quickly donned, hoping it would endear me to others of that ilk. Unfortunately, it did little more than muffle my voice. Next, I came across a props tent. Inside, I picked up a gorilla costume and a cardboard cut-out of President Taft: the first proved useless as a disguise because the head was missing; and the second just made me appear even more foolish.

My first major discovery was an unused circus ticket, which I spotted while filtering through the litter under the grandstand inside the Big Top. At this point in the game, you have to refer to the heaps of bumph accompanying the program. Only by reading how to use the ticket to negotiate an exasperating turnstile, will you progress any further.

Going through the turnstile takes you into a wonderland of sideshows and circus freaks. There's Tina, billed as 827 pounds of female charm; Andrew Jenny, the strangest anomaly of all, being half man/half woman; and Rimshaw the Incomparable, a hypnotist.

These strange characters *must* hold important clues as to the whereabouts of Chelsea, but how do you extricate them from the brains of such people?

The corpulent Tina is impervious to your importuning, thanks to a transistor radio she shifts from ear to ear, shutting out your maundering. Andrew Jenny, dressed in jack boots and stilettoes, is simultaneously aloof and charming, but remains silent. Only Rimshaw looks as if he could be useful.

Utilising Rimshaw's power of hypnosis, you find yourself sitting in the audience at one of the Circus That Time Forgot's performances. Looking along the row of fellow patrons, you spy a hawker selling various confectioneries. In an attempt to buy something, you pass your money along the line to the man. But, just before you receive your goods, the crowd rises in tumultuous appreciation of something that has happened in the ring. You lose your money, and whatever it is you were trying to buy. You must try to reach the hawker and give him the money yourself.

Traversing the rows of spectators takes you down to the ringside, where you are suddenly leapt upon by a hungry and malodorous chimp which baulks your every move.

Unfortunately, that is as far as I got. The voracious chimp can most probably only be shifted when fed with food bought from the hawker, so the real problem is how to buy the food without losing everything to the crowd.

Like all of Infocom's adventures, there are no easy solutions to any of the puzzles posed in Ballyhoo: its level of difficulty will probably surprise even afficianados of the company's past games. But if you like your adventures to have a bit of meat, and you're not worried about graphics, Ballyhoo is for you.

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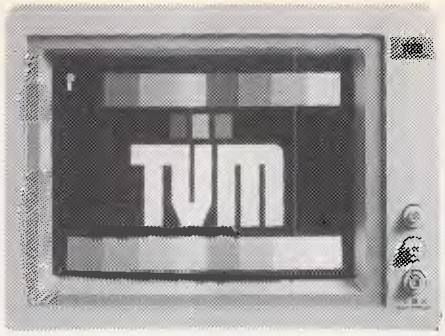

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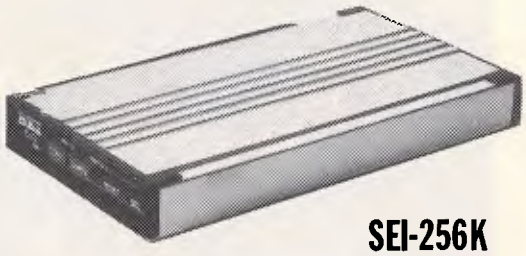

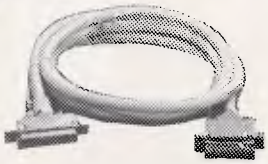

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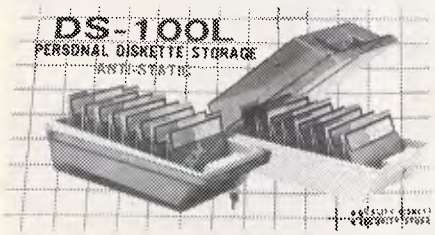

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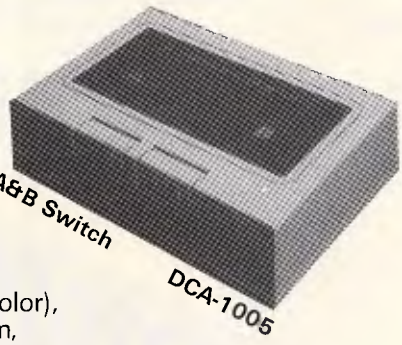

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Z80 TREE STRUCTURES

The five datasheets this month, from John Hardman, include nine subroutines which form the basis of a tree structure control suite.

The tree format used by John is to separate the data structured in this way from the actual nodes of the tree which each contain only a set of four addresses. In the Z80, and other machines limited to 16-bit addresses, each node requires eight bytes of contiguous random access memory.

Processors with larger address capabilities would obviously need correspondingly larger blocks of RAM for each node. The 68020, for example, has a 32-bit addressing capacity, and would need a 16-byte block of memory to hold each node if the full memory complement were to be accessed.

Fig 1 shows the connecting links of a simple tree structure of three nodes, with each node having the four fields needed by John's suite. Node A is the parent of nodes B and C. Note that since node A has no parent itself, nor no sibling, its parent and sibling link fields are self-referential and address the first byte of node A. Similarly, the child link fields of both nodes B and C and the sibling link field of node C are self-referential. The data address fields are not links and are never self-referencing.

The data ordered and accessed by this simple tree structure exists in a separate area of memory. It may be of variable length and arranged quite randomly, as the start address of each data block is read from the data address field of the appropriate node. This, too, is shown in Fig 1.

Although the suite is capable of starting new trees, appending new nodes or searching in depth-first or breadth-first order through an existing tree, John has not provided the means to delete nodes from a tree, nor the memory management routines which would be needed to keep a list of free blocks in a real application.

	DATA		PARENT		SIBLING		CHILD		
IX +	0	1	2	3	4	5	6	7	
A000	C8	AB	00	A0	00	A0	08	A0	NODE A
A008	C0	AB	00	A0	10	A0	08	A0	NODE B
A010	D0	AB	00	A0	10	A0	10	A0	NDDE C
ABC0	XX	XX	XX	XX	XX	XX	XX	XX	NODE B DATA
ABC8	XX	XX	XX	XX	XX	XX	XX	XX	NODE A DATA
ABD0	XX	XX	XX	XX	XX	XX	XX	XX	NODE C DATA

Fig 1

SEARCH ORDER

John has provided two methods of searching, or traversing, through the tree. Referring to Fig 2, a depth-first search would visit all the nodes in the order ABEFCGJKIDA, while a breadth-first search would visit in the order ABCDEFGHIJK.

Knuth, in *The Art of Computer Programming: Volume 1. Fundamental Algorithms* (Addison-Wesley, 1973), gives a full account of various tree structures and describes two principal ways to traverse non-binary trees. These are preorder, which corresponds to the depth-first search; and postorder, which would visit the nodes of the tree in Fig 2 in the order EFBGJKHICDA.

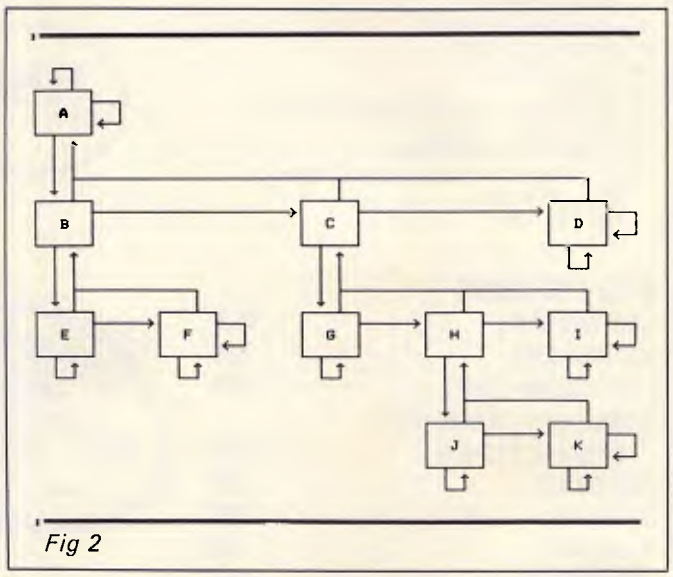

Fig 2

LINKAGE

The quadruple field linkage (actually three links plus data pointer) used in John's suite may be wasteful of memory and unnecessary in some applications. A similar method, which — with a little more computation — will provide equivalent

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information, disposes of the parent link in every node and uses only the sibling link of the youngest (right-most) child to refer back to the parent. This method does require a single bit flag to distinguish sibling from parent link.

With even greater reliance on computation and stacking of node addresses whenever reference passes to a deeper level, the parent link can be eliminated completely — although this usually results in slower access.

Alternatively, if greater linkage information is built into the structure, perhaps vertically up several levels or horizontally across branches of the tree, traversal times can be speeded up considerably. This type of distant linkage is known as 'threading' and is used to produce tolerable operating times in tree-structured computer languages, such as Forth.

The type and amount of linkage required for a useful tree structure depends entirely on the particular applications for which it is used. John's suite is generally useful and does provide a simple introduction to a fascinating field.
He suggests that anyone interested in pursuing the subject should read *Artificial Intelligence,* by Patrick Henry Winston (Addison-Wesley, second edition 1984). Knuth is a better bet but is rather complex.

More information on machine intelligence can be obtained from the three-volume, *The Handbook of Artificial Intelligence* (Pitman, 1981).

DATASHEET 1

```
;
;= PARENT - Address parent node.
;> SIBLNG - Address next younger sibling node.
;> CHILD  - Address child node.
;
;JOB        To address the next related node in a tree structure
;           as either the PARENT, next youngest SIBLING or
;           eldest CHILD or return the input address with flag
;           information to say no such node exists.
;
;           Node fields give the addresses of (a) node data,
;           (b) node above (PARENT), (c) node along (SIBLING)
;           and (d) node below (FIRST CHILD). Where no relative
;           node exists, the field is self-referent to the node.
;
;ACTION     Read address of required node from current node.
;           Compare new address - current address to set flag.
;-------------------------------------------------------------
;CPU        Z80
;HARDWARE   RAM containing 8-byte nodes.
;SOFTWARE   None.
;-------------------------------------------------------------
;INPUT      IX = current node address (1st byte).
;
;           NODE FORMAT (8 bytes, 4 fields):
;             Byte 1,0: Address of node DATA.
;             Byte 3,2: Address of PARENT node / current node.
;             Byte 5,4: Address of SIBLING node / current node.
;             Byte 7,6: Address of CHILD node / current node.
;           (N.B. Where no PARENT, SIBLING or CHILD node exists,
;                 the field contains the current node address.)
;
;OUTPUT     Z = 0: IX addresses required node.
;           Z = 1: IX unchanged.
;ERRORS     None.
;REG USE    IX F
;STACK USE  6
;RAM USE    None.
;LENGTH     38
;CYCLES     PARENT: 171.  SIBLNG: 171.  CHILD: 159.
;-------------------------------------------------------------
;CLASS 1     *discreet      *interruptable      *promable
;******      *reentrant     *relocatable        *robust
;=============================================================
;
PARENT PUSH HL          ;Save HL for use reading          E5
       LD   L,(IX+2)    ;address of parent node           DD 6E 02
       LD   H,(IX+3)    ;                                 DD 66 03
       JR   PSCZ        ;jump to common code.             18 10
;
SIBLNG PUSH HL          ;Save HL for use reading          E5
       LD   L,(IX+4)    ;address of next sibling node     DD 6E 04
       LD   H,(IX+5)    ;                                 DD 66 05
       JR   PSCZ        ;jump to common code.             18 07
;
CHILD  PUSH HL          ;Save HL for use reading          E5
       LD   L,(IX+6)    ;address of first child node      DD 6E 06
       LD   H,(IX+7)    ;fall through to common code.     DD 66 07
;
PSCZ   PUSH DE          ;Save DE for use comparing        D5
       PUSH IX          ;addresses. Get address of        DD E5
       POP  DE          ;current node in DE from IX.      D1
       PUSH HL          ;Copy address of desired node     E5
       POP  IX          ;from HL to IX.                   DD E1
       AND  A           ;Clear Cy and subtract current    A7
       SBC  HL,DE       ;from new address, setting Z.     ED 52
       POP  DE          ;Restore DE and HL used in        D1
       POP  HL          ;routines; and exit with Z set    E1
       RET              ;if output IX equals input IX.    C9
```

DATASHEET 2

```
;
;= NUTREE - Start a new tree structure.
;> ADCHLD - Add node to existing tree.
;
;JOB        NUTREE: To initialise the first node of a new tree.
;           ADCHLD: To initialise a node appended to an existing
;                   tree, adjusting the node(s) at place of
;                   insertion.
;ACTION     NUTREE:   Store new node addresses:
;                     (a) DATA (b) SELF (c) SELF (d) SELF.
;           ADCHILD:  IFTE ( PARENT node CHILD field valid. )
;                     [
;                       Address youngest CHILD.
;                       Change CHILD node SIBLING field to
;                       address new node.
;                     \
;                       Change PARENT node CHILD field to
;                       address new node.
;                     ]
;                     Store new node addresses:
;                     (a) DATA (b) PARENT (c) SELF (d) SELF.
;-------------------------------------------------------------
;CPU        Z80
;HARDWARE   RAM containing 8-byte nodes.
;SOFTWARE   SIBLNG, CHILD, (Datasheet 1).
;-------------------------------------------------------------
;INPUT      (For node format see Datasheet 1.)
;           NUTREE: HL = address for new node.
;                   DE = node data address.
;           ADCHLD: IX = address of PARENT node to which CHILD
;                        node is to be dependent.
;                   HL = address for CHILD node.
;                   DE = CHILD node data address.
;OUTPUT     NUTREE: IX = address of new node.
;                   All other registers & flags unchanged.
;           ADCHLD: IX = address of CHILD node.
;                   HL = address of PARENT node.
;                   Flags altered, other registers unchanged.
;ERRORS     No check for overwrite of existing tree memory use
;           (either data or nodes) by new node.
;REG USE    DE HL IX (also F in ADCHLD).
;STACK USE  8 (including subroutine usage).
;RAM USE    None.
;LENGTH     66
;CYCLES     NUTREE: 220.
;           ADCHLD: No SIBLINGS: 438.
;                    x SIBLINGS: 493 + (200 * SIBLINGS).
;-------------------------------------------------------------
;CLASS 2     ?discreet      *interruptable      *promable
;?*****-     *reentrant     *relocatable        -robust
;           NUTREE: *discreet.  ADCHLD: -discreet.
;=============================================================
;
NUTREE PUSH HL          ;Put address of new tree 1st node E5
       JR   TWIN        ;on stack and go set new node.    18 22
;
ADCHLD CALL CHILD       ;Get address of parents 1st child CD lo hi
       JR   Z,SINGLE    ;else skip if a terminal node.    28 15
;
ACLP   CALL SIBLNG      ;Repeat, get address of next      CD lo hi
       JR   NZ,ACLP     ;sibling until youngest child.    20 FB
;
       LD   (IX+4),L    ;Write new sibling address in     DD 75 04
       LD   (IX+5),H    ;erstwhile youngest node.         DD 74 05
       PUSH HL          ;Save new node address.           E5
       LD   L,(IX+2)    ;Get parent node address from     DD 6E 02
       LD   H,(IX+3)    ;erstwhile youngest... on stack   DD 66 03
       EX   (SP),HL     ;and new node address in HL.      E3
       JR   TWIN        ;Jump to new node write.          18 08
;
SINGLE LD   (IX+6),L    ;Write new node address in        DD 75 06
       LD   (IX+7),H    ;sibling field of parent.         DD 74 07
       PUSH IX          ;Save parent node address.        DD E5
;
TWIN   PUSH HL          ;Copy new node address to         E5
       POP  IX          ;current node pointer IX.         DD E1
       LD   (IX+0),E    ;Write data address to data       DD 73 00
       LD   (IX+1),D    ;field of new node.               DD 72 01
       LD   (IX+4),L    ;Write new node address to        DD 75 04
       LD   (IX+5),H    ;sibling field and                DD 75 05
       LD   (IX+6),L    ;child field as self reference    DD 75 06
       LD   (IX+7),H    ;because a terminal node.         DD 75 07
       POP  HL          ;Get parent node address and      E1
       LD   (IX+2),L    ;write to parent field in         DD 75 02
       LD   (IX+3),H    ;new node.                        DD 75 03
       RET              ;Exit, new node formed.           C9
```

DATASHEET 3

```
;
;= DFIRST - Depth first movement through tree.
;
;JOB        To address the next node in depth first search
;           pattern - moving down to eldest child if possible or
;           across to next branch if not - or set a flag showing
;           no further nodes available.
;ACTION     Save input node address.
```

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```
;           IFTE ( CHILD node exists. )
;           [
;             Address CHILD node.
;             Discard saved input node address.
;             Set node found flag.
;           \
;             REPU ( Node found or search end. )
;             [
;               IFTE ( SIBLING node exists. )
;               [
;                 Address SIBLING node.
;                 Discard saved input node address.
;                 Set node found flag.
;               \
;                 IFTE ( PARENT node exists. )
;                 [
;                   Address PARENT node.
;                 \
;                   Restore input node address.
;                   Set search end flag.
;                 ]
;               ]
;             ]
;           ]
;-------------------------------------------------------------------------
;CPU         Z80
;HARDWARE    RAM containing 8-byte nodes.
;SOFTWARE    CHILD, SIBLNG, PARENT, (Datasheet 1).
;-------------------------------------------------------------------------
;INPUT       IX = address of current node.
;OUTPUT      Z=0: IX = address of new found node.
;            Z=1: Input node was last in depth first search
;                 IX is unchanged.
;            Other flags changed, no other registers changed.
;ERRORS      None.
;REG USE     IX F
;STACK USE   10 (including subroutine use).
;RAM USE     None.
;LENGTH      23
;CYCLES      Not given.
;-------------------------------------------------------------------------
;CLASS 1     *discreet      *interruptable      *promable
;******      *reentrant     *relocatable        *robust
;=========================================================================
;
DFIRST PUSH IX          ;Save address of current node     DD E5
       CALL CHILD       ;and address 1st child, but skip  CD lo hi
       JR   Z,NXTNOD    ;to next sibling if no child.     28 03
;
DONE   INC  SP          ;Clear stack and exit with        33
       INC  SP          ;address of new found node        33
       RET              ;in IX and Z reset.               C9
;
NXTNOD CALL SIBLNG      ;Get address of any next younger  CD lo hi
       JR   NZ,DONE     ;sibling and exit, else...        20 FB
       CALL PARENT      ;(re-get) parent node and loop    CD lo hi
       JR   NZ,NXTNOD   ;for sibling at higher level,     20 F6
       POP  IX          ;unless at last node, retrieve    DD E1
       RET              ;node address and exit, Z set.    C9
;=========================================================================
```

DATASHEET 4

```
;-------------------------------------------------------------------------
;= NXTTRM - Next terminal node of tree.
;-------------------------------------------------------------------------
;JOB         To address the next terminal node of a tree
;            structure using depth first search technique, or
;            set flag showing no further terminal nodes
;            available.
;ACTION      Save input node address.
;            IFTE ( Next depth first search node exists. )
;            [
;              Address new node.
;              REPW ( CHILD node exists. )
;              [
;                Address CHILD node.
;              ]
;              Discard saved input node address.
;              Set node found flag.
;            \
;              Restore input node address.
;              Set search end flag.
;            ]
;-------------------------------------------------------------------------
;CPU         Z80
;HARDWARE    RAM containing 8-byte nodes.
;SOFTWARE    CHILD (Datasheet 1), DFIRST (Datasheet 3).
;-------------------------------------------------------------------------
;INPUT       IX = address of current node.
;OUTPUT      Cy=0: IX = address of new found terminal node.
;            Cy=1: Input node was last terminal node in depth
;                  first search pattern.
;                  IX is unchanged.
;            Dther flags changed, no other registers changed.
;ERRORS      None.
;REG USE     IX F
;STACK USE   12 (including subroutine use).
;RAM USE     None.
;LENGTH      20
;CYCLES      Not given.
;-------------------------------------------------------------------------
;CLASS 1     *discreet      *interruptable      *promable
;******      *reentrant     *relocatable        *robust
;=========================================================================
;
NXTTRM PUSH IX          ;Save address of current node.    DD E5
       CALL DFIRST      ;Get next node by depth first     CD lo hi
       JR   NZ,OK       ;search, skip if another node.    20 04
;
```

Quick Reference Guide PL/PC™

Document Highlighting and Notation

Bold	Items which must be typed in exactly as shown.
Underline	Parameters, substitute the underlined item with the appropriate value.
[...]	Optional item.
{...|...}	Select one item.
...	Zero or more of the previous item.

Special Symbols

~	Negative constant prefix.
@	Imaginary part indicator.
;	Statement and expression separator.
'	Character constant delimiter.
"	String constant delimiter.
[k]	Axis-specifier, the last coordinate is used if the axis-specifier is omitted.

Basic Data Types

Numeric (bit, pel, nibble, byte, integer, long, real and complex), character and string.

Maximum Array Rank

127 dimensions.

Maximum Array Size

Each ordinary variable must use less than 65,521 bytes of memory. File variable size is limited by available disk storage.

Workspace Size

Limited by available RAM.

Expressions

Left to right evaluation. Unary operators and indexing have the highest priority.

expr1?expr2:expr3
Conditional expression, returns expr2 if expr1 is true, otherwise return expr3.

{expr1;expr2 ...}
Output list.

expression:field_width:[decimal_places]type
expression:field_width
expression:type
Formatted print. Type ('b', 'o' and 'x' for binary, octal and hexadecimal output, respectively).

Scalar Unary Operators

+y	Conjugate of y
-y	Negation of y
*y	Signum of y
%y	Reciprocal of y
^y	Exponential of y
log y	Natural logarithm of y
floor y	Floor of y
ceiling y	Ceiling of y
|y	Magnitude of y
pi y	Pi times y
!y	Factorial of y
rand y	Random number from 0 to y-1
not y	Logical not of y
erf y	Error function of y
sin y	Trigonometric operators
cos y	
tan y	
asin y	Inverse trigonometric operators
acos y	
atan y	
sinh y	Hyperbolic operators
cosh y	
tanh y	
asinh y	Inverse hyperbolic operators
acosh y	
atanh y	
real y	Real part of y
imag y	Imaginary part of y
isqrt y	Integer square root of integer y

Scalar Binary Operators

x+y	Sum of x and y
x-y	Difference of x and y
x*y	Product of x and y
x%y	Quotient of x by y
x idiv y	Integer division of integer x by integer y
x^y	x to the power of y
x log y	Logarithm of y in base x
x min y	Smaller of x and y
x max y	Larger of x and y
x|y	Remainder of x%y
x!y	Number of combinations of y things taken x at a time, without repetition.
x jn y	Bessel operators
x yn y	
x atan2 y	Four-quadrant arctangent of x%y
x sin y	x*sin(y), y is in degrees
x cos y	x*cos(y), y is in degrees

Comparison Operators

x<y	x less than y
x<=y	x less than or equal to y
x>y	x greater than y
x>=y	x greater than or equal to y
x==y	x equal to y
x<>y	x not equal to y

Bit-wise Operators

x and y	Both x and y are true
x or y	Either x or y is true
x xor y	x and y are different
x<<y	x shifted left by y bit position
x>>y	x shifted right by y bit position
bitnot y	Bit-wise not of y

Composite Operators

op/[k]y	Reduction of y along the kth coordinate
op\[k]y	Scan of y along the kth coordinate
x op1.op2 y	Inner product of x and y

x outer.op y Outer product of x and y.
Where op1, op2 and op represents any binary operator.

Structuring Operators

,[k]y	Ravel of y along the kth coordinate
reverse[k] y	Reversal of the kth coordinate of x
transpose y	Transpose of y
x,[k]y	Join x and y along the kth coordinate
x rotate[k] y	Shift vectors along the kth coordinate of y by x
x transpose y	Interchange coordinates of y according to x
x dim y	Reshape y to dimensions x

Selection Operators

x take y	Take the first (last) x elements of y when x is positive (negative)
x drop y	Drop the first (last) x elements of y when x is positive (negative)
x/[k]y	Logical compression along the kth coordinate of y
x\[k]y	Logical expansion along the kth coordinate of y
x[y]	Array indexing/selection
range y	Minimum and maximum of y

Integer Generating Operators

index x y z	Generate integers x to y-1 in step of z
index1 y	Generate integers 1 to y
gradeup[k] y	Indices of y sorted in ascending order along the kth coordinate
gradedown[k] y	Indices of y sorted in descending order along the kth coordinate
x index y	First index of element in vector y whose value is equal to x
x in y	Membership of x in y
shape y	Shape of y
x rand y	x integers selected randomly without replacement from 0 to y-1

Evaluation Operators

eval y	Evaluates character string y
x base y	Value of y evaluated in number system x
x rep y	Representation of y in number system x
mdiv y	Matrix inverse of y
x mdiv y	Matrix division of x by y
fft y	Fast Fourier Transform of y

Conversion Operators

num y	Converts y to numeric
char y	Converts y to character
string y	Converts y to string

Graphics

circle(y0,x0,radius;data)	Draw circles
clrscr	Clears graphics screen
conic(y0,x0,j,k,l,m,s,e;data)	Draw conic sections
fill(y0,x0,y1,x1;data)	Fill rectangular areas
r = getimage(y0,x0,y1,x1)	Gets image from screen
graphwindow = top,left,bottom,right	Graphics window
label(y0,x0;data)	Writes text to graphic screen
line(y0,x0,y1,x1;data)	Draw lines
paint(y0,x0;data)	Fill arbitrary areas
palette = background,foreground	Color palette
point(y0,x0;data)	Plot points
polygon(y0,x0;data)	Draws continuous line
putimage(y0,x0;data)	Puts image on screen
screen = x	Screen mode

Turtle Graphics

angle = x	Incremental size of direction in move command
delay = x	Delay between move
move(direction;distance)	Moves turtle distance pixels in direction
pen = x	Pen up or down
position = row,column	Position of turtle
turtle = x	Display/Non-display of turtle

Screen

clr	Clears text screen
color = x	Color data
cursor = column,row	Cursor position
digits = x	Significant digits to be printed
eeol	Erases to end of line
eeos	Erases to end of screen
delchar	Deletes character
delline	Deletes line
inschar	Inserts character
insline	Inserts line
output = x	Creates history file
page = x	Page size
window = top,left,bottom,right	Text window

Keyboard

r = ask string	Gets value from keyboard
r = getline string	Gets a line from keyboard
r = inkey	Gets a key stroke from keyboard
r = keypressed	Checks if key is pressed

Direct Access to Files, Memory and Ports

r = file(type;shape;name,mode)	Creates data structure to access file. Mode ('r', 'w' and 'n' for read only, read-write and new, respectively)
r = memory(type;shape;address)	Creates data structure to access absolute address
r = inb port	Inputs byte from port
r = inw port	Inputs word from port
outb(port;value)	Outputs byte value to port
outw(port;value)	Outputs word value to port
sound(frequency;duration)	Sounds speaker with frequency for duration tick

Workspace Management

clear	Clears the workspace
copy work_space [objects ...]	Copy objects from work_space
del work_spaces ...	Delete work_spaces
dos dos_command	Executes dos_command
edit [object]	Edits object
erase objects ...	Erase objects
fns [subroutine]	List subroutine headers or body of subroutine
r = free	Size of free memory in bytes
input source_file	Inputs program from source_file
keep	Saves current workspace and exits to system
latent = x	Latent expression
lib [directory]	List workspaces in directory
load work_space	Loads in work_space
pcopy work_space [objects ...]	Protected copy of objects from work_space
save [work_space]	Saves current workspace to work_space
vars [x]	List variables in workspace
sysvar	List system variables
system	Exits to system
wsid = x	Name of current workspace

System Variables

assertlevel = x	Assertion level
autoparagraph = x	Auto-paragraphing on/off
branch = x	Complex number branch
date = year,month,day	Current date
fuzz = x	Comparison tolerance
seed = x	Seed of random number generator
time = hour,minute,second,hundredth of second	Time of day

Debugging

trace objects	Enable tracing of objects
notrace objects	Disable tracing of objects
stop object	Enable stopping of objects
nostop objects	Disable stopping of objects
next	Single stepping
profiler = x	Enables/disables profiling
timer = x	Enables/disables timing
resume	Resumes execution
stack	List suspended subroutines
operand(x)	Gets the xth item from the operand stack
=>	Exits from last suspended subroutine

Subroutine Declaration

```
procedure name[parameters] or
operator name(right parameter) or
operator name(left parameter right parameter) or
function name(parameters) [forward]
[var x y z ...]
[static a b c ...]
[subroutine declarations]
begin
    statement_list
end
```

Statement_list

statement [; statement_list]

Statement

```
for index = first_value [to|downto] last_value
[step size] do
    statement_list
end

while boolean_expression do
    statement_list
end

repeat
    statement_list
until boolean_expression

loop
    statement_list
end

break

continue

if boolean_expression then
    statement_list
elself boolean_expression then
    statement_list
else
    statement_list
end

case expression of
value constant0:
value constant1:
    statement_list
value constant2:
    statement_list
else
    statement_list
end

return [expression]

halt

assert assertion_level : boolean_expression

variable = expression

expression
```

```
        POP   IX          ;Else recover input node address   DD E1
        DR    A           ;and clear Cy to show input was    B7
        RET               ;last terminal node, on exit.      C9
;
OK      CALL  CHILD       ;Repeat, find oldest child of      CD lo hi
        JR    NZ,OK       ;this node, until terminal node.   20 FB
        INC   SP          ;Clear stacked input address.      33
        INC   SP          ;                                  33
        SCF               ;Set Cy to show new terminal       37
        RET               ;node found, on exit.              C9
```

DATASHEET 5

```
;= NXTROW - Leftmost node of next depth.
;> LEVEL  - Next node at current depth.
;
;JOB         NXTROW: To address the leftmost node of the tree
;                    structure at one level greater depth or set
;                    flag showing no further node exists.
;            LEVEL:  To address the neighbouring node at the same
;                    level of the tree structure or set flag
;                    showing no further node exists.
;ACTION      NXTROW: Save input node address.
;                    Set count = 1.
;                    REPW ( PARENT node exists. )
;                    [
;                      Address PARENT node.
;                      Count = count + 1.
;                    ]
;                    PROC: 'FURTHA"
;
;            LEVEL:  Save input node address.
;                    Set count = 0.
;                    REPW ( SIBLING node does not exist
;                           AND search end flag not set. )
;                    [
;                      IFTE ( PARENT node exists. )
;                      [
;                        Address PARENT node.
;                        Count = count + 1.
;                      \
;                        Set search end flag.
;                      ]
;                    ]
;                    Address SIBLING node.
;                    PROC: "FURTHA"
;
;            FURTHA: REPW ( Count > 0 AND end flag NOT set. )
;                    [
;                      CASE ( CHILD | SIBLING | PARENT | CABED. )
;                      [
;                        Address CHILD node.
;                        Count = count + 1.
;                      \
;                        Address SIBLING node.
;                      \
;                        Address PARENT node.
;                        Count = count + 1.
;                      \
;                        Set search end flag.
;                      ]
;                    ]
;                    IFTE ( Count = 0. )
;                    [
;                      Discard saved input node address.
;                      Set node found flag.
;                    \
;                      Restore input node address.
;                    ]
;
;CPU         Z80
;HARDWARE    RAM containing 8-byte nodes.
;SOFTWARE    PARENT, SIBLNG, CHILD, (Datasheet 1).
;
;INPUT       IX = address of current node.
;OUTPUT      Z=0: IX = address of new found node.
;            Z=1: Input node was last in breadth first search.
;                 IX is unchanged.
;            Other flags changed, no other registers changed.
;ERRORS      None.
;REG USE     IX F
;STACK USE   12 (including subroutine use).
;RAM USE     None.
;LENGTH      57
;CYCLES      Not given.
;
;CLASS :     *discreet      *interruptable      *promable
;******      *reentrant     *relocatable        *robust
;
;
NXTROW PUSH BC          ;Save for use as depth counter.    C5
       PUSH IX          ;Save current node address.        DD E5
       LD   BC,0        ;Depth count = 0 for extra INC.    01 00 00
;
REPEAT INC  BC          ;Find highest node address and     03
       CALL PARENT      ;calculate depth of input node.    CD lo hi
       JR   NZ,REPEAT   ;                                  20 FA
       JR   FURTHA      ;Get next depth, leftmost node.    18 15
;
LEVEL  CALL SIBLNG      ;If younger sibling exists, then   CD lo hi
       RET  NZ          ;return its address, Z reset.      C0
       PUSH BC          ;Else save to use as depth count.  C5
       PUSH IX          ;Save current node address.        DD E5
       LD   BC,0        ;Depth count = 0                   01 00 00
;
AGAIN  CALL PARENT      ;If top node, exit with Z set      CD lo hi
       JR   Z,TOP       ;returning input node address.     28 18
       INC  BC          ;Else address parent, inc count.   03
;
RIGHT  CALL SIBLNG      ;Address next sibling, else no     CD lo hi
       JR   Z,AGAIN     ;sibling so go get parent.         28 F5
;
FURTHA CALL CHILD       ;Address 1st child, else no        CD lo hi
       JR   Z,RIBHT     ;child so go get sibling.          28 F6
;
       DEC  BC          ;Child got so dec depth count.     0B
       PUSH AF          ;Save AF for count test.           F5
       LD   A,B         ;Test depth count BC for 0.        78
       OR   C           ;If right depth got then exit,     B1
       JR   Z,ZERO      ;clearing Z, with new node addr.   28 03
       POP  AF          ;Else restore AF and go seek       F1
       JR   FURTHA      ;correct level.                    18 F2
;
ZERO   POP  AF          ;Restore AF from count test.       F1
       INC  C           ;Reset Z to show node found.       0C
       POP  BC          ;Clear input node addr off stack.  C1
       DEFB 1           ;Do byte miser's trick to make     01
                        ;next POP IX into LD BC,0E1DDH.
;
TOP    POP  IX          ;(Restore input node address.)     DD E1
       POP  BC          ;Restore BC.                       C1
       RET              ;Exit, addr in IX, Z flags.        C9
;
```

DATASHEET ACTION

A few readers have complained that conversion of some SubSet routines to other codes is not helped by a tendency of these formal descriptions to reflect the coding capabilities of the processor for which the routine is written, nor by the confusing compact use of square brackets.

From suggestions put to me by various people, I have revised the format of the ACTION section to display the structure far more clearly. I have also made the attempt to describe the operation performed in such a way that the job could easily be coded for any processor, rather than echoing the more 'optimised' structuring of the code.

I have introduced several control words which are limited to a four-letter length for spatial economy. Their meanings should be quite clear to anyone used to a structured language, but to dispel any doubts, here's a full definition:

'IFTE' — IF....THEN... ELSE: binary selection on condition

'CASE' — Case — multiple selection, nested 'IFTE'

'REPI' — REPEAT IF condition true (end tested)

'REPU' — REPEAT UNTIL condition true (end tested)

'REPW' — REPEAT (or DO) WHILE condition holds (start tested)

'PROC' — PROCESS described separately

Conditions are contained in braces (curly brackets) and are separated, if multiple, by the vertical bar. Corresponding actions are enclosed in square brackets and are separated by the reverse oblique (backslash).

END

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☐ Cable $30 ☐ Viatel s/w $25

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ADDRESS:_____

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P/CODE:_____

Enclosed please find cheque/ purchase order/ Bankcard/ VISA/ Mastercard #_____

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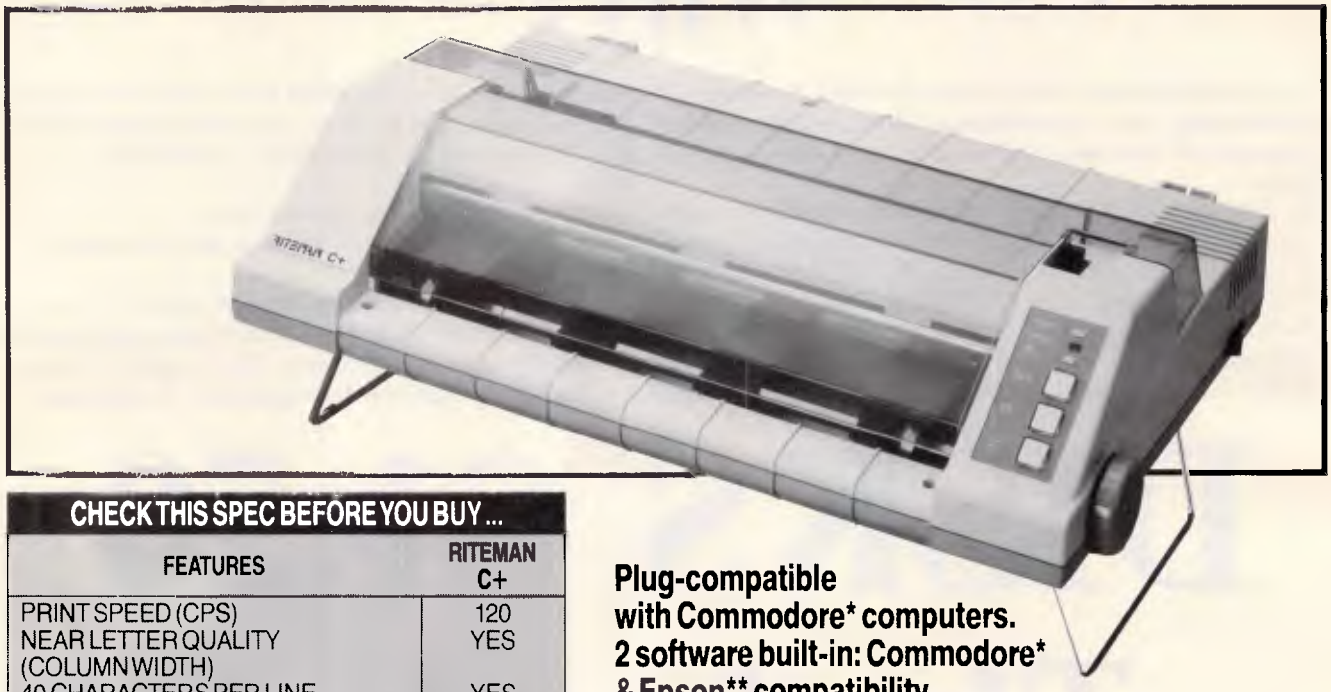
Add $7 per modem for insured overnight KWIKASAIR courier.

The perfect match...

COMMODORE RITEMAN



CHECK THIS SPEC BEFORE YOU BUY ...

FEATURES	RITEMAN C+
PRINT SPEED (CPS)	120
NEAR LETTER QUALITY	YES
(COLUMN WIDTH)	
40 CHARACTERS PER LINE	YES
80 CHARACTERS PER LINE	YES
66 CHARACTERS PER LINE	YES
132 CHARACTERS PER LINE	YES
(PAPER HANDLING)	
FRONT LOADING FOR EASY PAPER SETTINGS	YES
BUILT-IN PRINTER STAND	YES
PRINT ON POST CARDS	YES
(SOFTWARE COMMANDS)	
DOUBLE STRIKE	YES
EXPANDED	YES
EMPHASIZED	YES
COMPRESSED	YES
UNDERLINE	YES
SUPER/SUBSCRIPTS	YES
ITALICS	YES
DOUBLE DENSITY BIT IMAGE	YES
(CHARACTERS)	
9 × 9 FONT	YES
TRUE DESCENDERS	YES
ITALICS	YES
COMMODORE GRAPHICS	YES
(OTHER FEATURES)	
SINGLE DENSITY BIT IMAGE	YES
EXPANDED	YES
REVERSE	YES

Plug-compatible with Commodore* computers. 2 software built-in: Commodore* & Epson compatibility.**

If you own a Commodore computer ... or are thinking about getting one ... you're going to want the Riteman C+ dot matrix printer. You'll really appreciate that added convenience, versatility and economy.

Its unique front loading design lets you use plain paper of any thickness, elminates positioning and aligning problems and keeps continuous-feed paper away from entangling cables and connectors. Just compare the spec. table ... complete with a built-in Commodore interface and all necessary cables and connectors ... the Riteman C+ is the RIGHT printer for your Commodore System.

*Commodore is a registered trademark of Commodore Business Machines Inc.
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AUCKLAND: (09) 444 2645

WF 997/81

On the boards

This month Steve Withers presents a list of new bulletin boards emerging across the nation, and fills us in on the latest buzz words.

The Control Data Corporation is probably best known to micro users for its floppy disks, or possibly vocational training courses. However, its main business is the production of big and expensive computer systems, the top end of the range falling into the supercomputer category.

Over the years, CDC has spent a lot of time and a huge quantity of money on the development of a computer-aided instruction system called Plato. If you watched any of the "isn't information technology wonderful" TV programs that appeared a few years ago, you probably saw a demonstration of Plato. It uses lots of graphics and is highly interactive. Because Plato was developed to run on CDC's Cyber computers, it was only available to very few people. A small number of courses were produced to run on home computers but, as far as I am aware, they weren't very successful.

Plato has been running on a Cyber at the Western Australian Regional Computer Centre, University of Western Australia for some time, and it is now available to the public.

The system offers over 1000 lessons, covering such areas as computer programming, maths, reading and writing, sciences, office skills, and foreign languages. Games, electronic mail, and bulletin boards are also provided.

To use Plato, you need three things: a V23 (1200/75) modem with a 96 character buffer, a computer (IBM PC or clone, Commodore 64 or 128, Apple IIe or IIc, Macintosh, HP150, or NEC APC), and a credit card. If you don't have a Bankcard, Visa, or Mastercard you're out of luck, as that's the only way private users are billed! If your computer were missing from the list, software for the Apple II, II+, and III, as well as the NEC APC III will be available soon. Atari owners will have to wait until next year.

There is an initial fee of $99, which includes the software for your particular computer, manuals, and two hours' use of Plato. After that, you're charged $10 per hour during peak time (8am-5pm Monday-Friday) or $5 per hour off-peak, plus an annual renewal fee of $25.

Private individuals and small businesses can obtain further information from Ruth M Clark, VIA, 27 King Street, Gosnells, WA 6110. Corporate customers should write to Computer Aided Learning Service, 16 Ord Street, West Perth WA 6005.

Abbreviations

I get the feeling that there are several bulletin board users who like word puzzles, as some strange abbreviations sometimes crop up in electronic messages. Two popular ones are "advTHANKSance" (thanks in advance) and "cul" (see you later).

Then there are the 'smileys', put in a message to show that the words shouldn't be taken seriously. An ordinary smiley looks like this

:—)

(turn the page sideways if you don't see it immediately), and there's also the sly wink

;—)

or the inscrutable smile.

¦—)

A slight modification gives a glum face

:—(

as in "my system crashed again :—(".

If you know of any other whimseys like these, please send them to me.

System news

There are quite a few changes in the listings this month, so I'll keep things brief.

Terry Sweetser of AppleQ (Queensland) has asked for the opportunity to publicly thank NetComm for its offer of help in setting up a bulletin board. The AppleQ BBS should be on-line by Christmas.

Terry also puts in a good word for Midnight Express — "easily the best piece of software runing on a BBS in Oz."

I'm pleased to see the emergence of systems catering for particular (non-computing) interests. One example is Melbourne's, The Outer Limits — "the bulletin board that brings you the world of science fiction". It's not really surprising that science fiction is one of the first subjects to be covered in this way, as the two interests tend to go hand in hand.

Max Moore, the operator of Mail Bus tells me that he has added a new feature: the graffiti bulletin board. Access to this area of Mail Bus is granted on payment of half the normal subscription (presumably paid-up users get access). Messages are labelled with pseudonyms, not real names, and no censorship is applied to the contents. Apparently it's very popular!

It seems that FidoNet is taking off in Australia, with at least half a dozen systems in Sydney and Melbourne joining this international network. Some of the messages arriving from overseas are along the lines of "pen pal wanted", so if that appeals to you, why not sign up with a Fido? I'm trying to ensure that details of these systems appear in the listings, but there are several missing (can you help fill in the gaps?).

This month's information providers were Graham Busch, Stephen De-Gabrielle, John Dyson, Larry Lewis, Duncan McKinnon, Max Moore, James Williams, and Tom Worthington.

APC's listings now incorporate information from the AED-Prophet Australian PAMS Listings. Contributors are encouraged to forward any information to the Australian PAMS Coordinator as well as to myself.

New systems

NSW

Adventure Line (02) 636 9027. 10pm-5pm weekdays, 10pm-8am weekends.

Australian Connection (02) 625 4418. MV. Tim Hume. 24 hours daily.

Ausborne (02) 439 7072. MV. Ausborne Ltd. 24 hours daily.

Blackboard (02) 526 1343. MV. Will Black.

Bounty (02) 918 3256. MV. David Lloyd. 24 hours daily.

Fantasy (02) 93 5225. MV. 9pm-7.30am daily.

Freecom (02) 525 0051. MV. 24 hours daily.

Info Centre (02) 344 9511. MV. Paris Radio. 24 hours daily.

Information Connection (02) 521 1359. Roy King. 24 hours daily.

Nebula (02) 407 2729. MV. Sean Craig.

NSW Ace (02) 529 2059. MV. Larry O'Keefe. 24 hours daily.

OS9 Connection (02) 451 2954. MV. Graeme Nichols. 7.30pm-10pm Tuesday and Thursday, 10pm Saturday-6am Sunday.

Realtors (02) 387 5335. 24 hours. V22, Bell 103, Bell 212. A FidoNet system.

Sci-Fi (02) 646 4865. P. Greg Hope. 10pm-5pm daily. V21, V23.

Syntax's Error (02) 645 3406. MV. 24 hours daily.

Abacus (057) 83 1964. Maurice Copeland. 8am-noon, 4pm-midnight daily. V23.

Abcom (047) 36 4165. MV. Ben Sharif. 24 hours daily. V21, V22.

Infocom (042) 61 5094. 24 hours daily.

Jupiter (063) 31 5041. P. John Dyson. 9pm-10.30pm daily. Phone will be answered by a person.

ACT

Comtel (062) 26 1383. MV. Warren Mason. 24 hours daily.

Victoria

Colour (03) 579 2147. P. Alan Eales. 11pm-8am daily.

Commodore Board (03) 875 1023. P. Keith Jarvis. 10pm-8am daily.

Harbourd (03) 587 2504. MV. David Harbour. 24 hours.

The Outer Limits (03) 725 6650. P. "Captain Kirk". 5pm-6am weekdays, 24 hours weekends. Science fiction: stories, quiz, and reviews.

Public Resource (03) 690 7220. P. D Harvey, W Clarke, R Nagy. 24 hours daily.

TERMICOMNET (03) 589 1692. P. 24 hours.

Queensland

The Hacker's Hotline (07) 800 2281. "Dr Who". 5pm-6am weekdays, 24 hours weekends. V21, and either V22 or V23.

WA

Mindstorm (09) 448 9357. Andrew Ferguson. 24 hours daily.

Perth PC Users (09) 227 9229. 24 hours daily.

Z-Node 62 (09) 450 0200. Lindsay Allen. 24 hours daily.

Updates

NSW

Ace (02) 560 9846. Jeff Maddock. 6pm-9am weekdays, 24 hours weekends.

AUGABBS (02) 451 6575. MV. Matthew Barnes and Andrew Riley. 24 hours daily. V21, V22, V22bis, V23.

Arco-Tel (02) 683 3956. M. Alex Szx. 24 hours daily.

Augur (02) 661 4739. MV. Mark James. 24 hours daily.

CCUA (02) 599 7342. M. Eric Davis. 24 hours daily.

Color Connection (02) 618 3591. MV. Barry Dornton. 24 hours daily.

Computer Connection (02) 528 1382. M. Hamish Bowly. 5pm-9am weekdays, 4pm Saturday-9am Monday.

Contact (02) 550 1004. MV. Steven Williams. 24 hours daily. V21, V22, V23, Bell 103. Computer dating.

Csace (02) 529 8249. MV. Larry O'Keefe. 24 hours daily.

Dick Smith Electronics (02) 887 2276. P. Mark Grimmond. 24 hours daily.

Frontier Systems (02) 875 2606. MV. Bryan Wilde. 24 hours daily. A FidoNet system.

Galaxy (02) 875 3943. MV. Chris Nelligan. 24 hours daily.

Irata (02) 600 9041. MV. Paul Sommers. 6pm-midnight weekdays, 24 hours weekends. Possibly off-line: can anyone confirm?

Info Centre (02) 344 9511. MV. Paris Radio. 24 hours.

Infocom (042) 61 5094. 24 hours daily.

Micro Design Lab (02) 663 0150, (02) 663 0151. P. Kevin Lowton. 24 hours daily.

Omega Line (02) 457 8281. P. Geoff Arthur. 24 hours daily. V21, V22, V23.

Omen I (02) 498 2495. MV. Ted Romer. 4.30pm-9am weekdays, 24 hours weekends. V21, V23.

Palantir (02) 451 6576. P. Steve Sharp. 24 hours daily. V21, V22, V23.

Phantom Land (02) 399 7716. MV. Bob James. 24 hours daily.

Prophet (02) 628 7030. MV. Larry Lewis. 24 hours daily.

Pursuit (02) 522 9507. MV. Warren Hillsdon. 24 hours daily.

Renegade (02) 631 2715. P. Sam Sarkis. V21, V22, V22bis, V23. A FidoNet system.

Sentry (02) 428 4687. MV. Trev Roydhouse. 9pm-6am weekdays, 8pm-6am weekends.

SMUG-Bee (02) 607 7584. MV. Bob Fryer. 24 hours daily.

Sydney PC Users Group (02) 238 9034. MV. Geoff May. 24 hours daily. Also on (02) 221 5520 for V22. Bytenet listings.

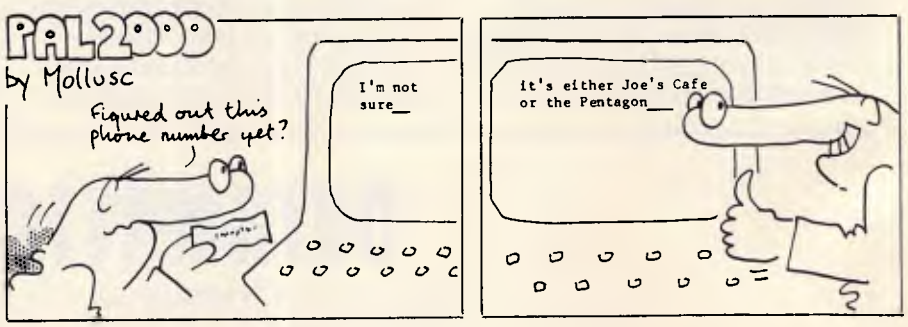
Tandy (02) 625 8071. MV. 24 hours daily.

Tesseract (02) 651 1404. MV. John Hastwell-Batten. 24 hours daily. V21, V22, V22bis, V23.

Tube Line (02) 681 3376. P. Mark Buckingham. 24 hours daily.

Zeta (02) 627 4177. MV. Nick Andrew. 24 hours weekdays, 7pm-7am weekends.

Appletech (042) 71 5514. MV. Peter



Tomlin. 8pm-11pm weekdays, 6pm-midnight weekends. Possibly off-line: can anyone confirm?

Illawarra (042) 84 4354. MV. John Simon. 24 hours daily.

ACT

ACT Apple. Off-line.

Canberra RBBS. Off-line.

Commodore User Group (062) 54 7365. MV. James Hacker. 24 hours daily.

Fatcat (062) 41 4395. MV. Harry Cooper. 24 hours daily. Formerly known as DSA-80.

PC Exchange (062) 58 1406. MV. 24 hours daily. V21, V22. Formerly known as Canberra IBBS.

Victoria

Atlantis International Computers (03) 277 6824. P. John Edwards. 24 hours daily. V21 and V22.

AUSOM MacSIG (03) 435 9152. P. 24 hours daily. V21, V22.

Hisoft Node 1 and Node 2. Off-line.

Microbee (03) 82 1571. Mike Thompson. 24 hours daily.

National (03) 819 5582. John Blackett-Smith. 24 hours daily. V21, V22, V22bibs. A FidoNet system.

Sunshine. Off-line.

Mail-Bus (051) 27 7245. MV. Max Moore. 24 hours daily. Now allows non-members to read and reply to bulletin board messages.

Queensland

Brisbane Microbee (07) 38 4833. P. Graham Scott. 24 hours daily.

Competron (07) 52 9498. 5pm-8am weekdays, 24 hours weekends.

Hi-Tech (07) 38 6872. Clyde Smith-Stubbs. 24 hours daily.

SA

Adelaide Micro Users Group (08) 271 2043. MV. Richard Newcombe. 24 hours.

The Electronic Oracle (08) 260 6686. MV. Don Crago and Grayham Smith. 24 hours daily. V21, V22, V22bis, V23. Also on (08) 260 6222 for V21 only.

Multiple (08) 255 5116. MV. Danny Vosso. 9pm-9am daily.

Omen V (08) 382 4631. MV. Richard Siggs. 24 hours daily.

WA

Mouse Exchange (09) 330 5530. Leonard Hollings. 8pm-7am weekdays only.

NEMO (09) 370 1855. Graeme Platt. 24 hours daily. V21, V23.

Omen III (09) 249 1555. Greg Watkins and Nigel Read. 24 hours daily. V21, V23.

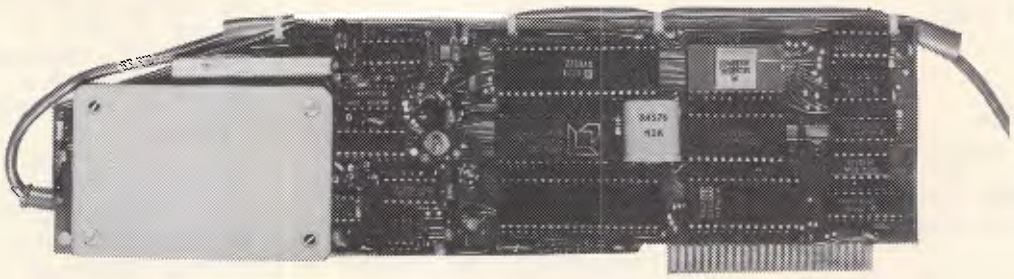
The PAD (09) 337 2941. Mark Lillywhite. 24 hours daily. V21, V23.

The material in this column is presented in good faith, but as it is collated from material provided by readers, *APC* cannot take responsibility for its accuracy. New information and corrections are always welcome (but please mention whether or not you can vouch for the accuracy of the material you provide), and should be sent to Steve Withers at one of the following addresses: C/- Computer Publications, 77 Glenhuntly Road, Elwood, Vic 3184. Viatel 063000030, Teledata 11UNRWITHERS.

Acknowledgements will normally be made through this column. You may also like to send a copy of the information to the Australian PAMS Coordinator at one of these addresses: PO Box E41, Emerton, NSW 2770; ACSnet prophet-@runx; Teledata prophet; Prophet Bulletin Board (02) 628 7030. END

MODEM FOR APPLE II & IIE

NOW IN STOCK WITH FULLY OPERATIONAL FIRMWARE & NEW FEATURES



* Super intelligent direct connect MODEM/VIATEL terminal for APPLE II, IIE & compatibles fully contained on a single card — plugs into slot#2 — does not require separate serial card or software. All software is permanently resident in an onboard 128K EPROM. It is hidden in the slot#2 card space, leaving the whole of memory completely free for other programs unlike disk based comms software which must occupy the main memory excluding other programs. It is menu driven and automatically senses for ProDos or DOS 3.3 operation. Received files are appropriately converted before saving and can be used.

Sending/receiving files is very simple:—
— Press "ESC" to display menu.
— Select "(S) END A FILE" option
— Answer the prompt "FILENAME?:"

The modem will search the disk for the file, make all the decisions (e.g. binary, basic, textfile, DOS 3.3 or ProDos) and transmit it in the correct format. <CR> transmits the file in memory. Similarly to receive a file select "(R) ECEIVE A FILE" option.

* AUTO ANSWER — AUTO DIAL. Senses true dial tone, ring tone, busy tone and acts intelligently, returning status messages. Characters can be included in the phone number to set baudrate, pause, "await dialtone" and multiple redial on busy. On answer, it selects the incoming baudrate by precision frequency measurement. This is much more reliable than the normal autosearch using carrier detect which is often confused by voice and phone tones. A reliable autosearch is a must for bulletin board operation.

* 300 Baud full duplex or 1200/75 and 75/1200 with fast automatic line turnaround. An upgrade kit to add V22 (1200/1200 baud) and V22 Bis (2400/2400 baud) will be available later.

*Main menu option "(V)IDEOTEXT" shows the VIATEL menu. It becomes a full graphics VIATEL terminal, automatically dialling and transmitting the user ID stored in the battery backed ram. When online, a keypress will immediately save pictures to memory. These can be reviewed later and selectively saved to disk or printed (requires a graphics printer card). Pictures can be loaded from disk and printed out. The modem can act as a videotext host and can be programmed to act on frame information. e.g. — use the clock to ring "MONEYWATCH" hurly and dial you at the office if your shares move outside a given range.

* TELESOFTWARE DOWNLOAD facility to purchase programs over VIATEL from suppliers such as MICROTEX 666 and TANGO.

* A full wordprocessor in EPROM for pre-composition of text before transmission. It can also be used to edit or print received files as well as for general wordprocessing.

* Onboard battery backed calendar clock can time and initiate calls or keep an activity log. ProDos uses it to time and date disk files and it is accessible from Basic.

* 2Kx8 battery powered CMOS RAM stores default parameters, phone numbers, ID, password, logon strings, search codes and setup parameters (e.g. baud rate, parity, printer ON) for each number, allowing single keystroke call establishment to specific areas of complex databases. Main menu option "(T)ELELIST" displays the list of 23 names and one is selected.

* Incorporates XON/XOFF and CHRISTENSEN error correcting protocol. Textfiles are not so fussy but error correction is a must when transferring program files. A debug function can display normally invisible control characters sent by the host.

* Can output directly to printer even when online at 1200 Baud — a fast printer is not required as the printer is spooled out of the receive buffer. A "FILTER" function is available to remove screen control characters from textfiles (these can drive a printer crazy). Special scroll routines print to 80 column screen and printer at 1200 Baud without any lost characters.

* Unique "PHANTOM MODEM MODE" function allows the modem to be permanently connected with the normal phone. When answering, if it doesn't immediately detect a calling modem it generates ringing tone back to the calling party and sounds the APPLE bell, giving you 60 seconds to answer the phone.

* If you have previously purchased this modem and have not yet received an updated EPROM VERSION V2.18 and a manual, contact AUTOMATIC ICE CO. — there is no charge for these.

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10 SMITH STREET, CHARLESTOWN, 2290.
PHONE (049) 63 3188 — (049) 63 1386

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Below is a list of updates and additions to the full User Group Index published in the June issue of APC. The next full listing will appear in the December issue of APC.

NEW SOUTH WALES

The Gosford Commodore User Group (GOSCOM) meets on the third Wednesday of each month at Narara Public School, Narara, commencing at 7.30pm.

The GOSCOM members' bulletin-board, COM-LINK operates 24 hours and may be contacted on (043) 41 3135.

For more details contact GOSCOM, PO Box 86, Umina NSW 2257.

A new user group for Hewlett-Packard desktop and portable computers has recently been formed. H-PUG (Hewlett-Packard User Group) may be contacted by writing to: H-PUG, C/- Darren Stokes, 3 Buckley Drive, Coonamble NSW 2829.

The Sydney Commodore User Group, Sydcom, is presently holding meetings on the second Wednesday of each month at 7.30pm at the Cricketers' Club, 11 Barrack Street, Sydney. For more details contact: Sydcom, Box 1542 GPO, Sydney NSW 2001.

The Spellbinders User Group caters for all users of Spellbinder. Meetings are held at 6pm, on the fourth Monday of each month. The venue is the ground floor, Trades Hall, corner of Dixon and Goulbourn Streets, Haymarket. For more information contact: Michael Burlace, PO BOX 171, Matraville NSW 2036. Tel: (02) 694 1033 (BH).

A new user group, Cass-Gamer has been formed. It is a subsidiary of the 80-Gamer User Group, but provides separate services for other microcomputers. The group supports TRS-80 models I and III, System-80 and Amstrad machines. More details may be obtained by writing to: Cass-Gamer, PO Box 584, Port Macquarie NSW 2444.

The Sydney Kaypro User Group, SKUG, caters for 8-bit and 16-bit Kaypro computers. SKUG meets on the second Tuesday of each month at the Burwood RSL club, 96 Shaftsbury Road, Burwood, commencing at 8pm. For more information contact Hans Schneider, 122 Murriverie Road, North Bondi NSW 2026. Tel: (02) 309 2961.

PCUG meets on the third Monday of each month at the Esso conference Centre, 1st Floor, 35 Clarence Street, Sydney, commencing at 5.30pm. For more information contact Mick Rowney (02) 666 4716.

DBUG meets on the third Tuesday of each month at the Australian Computer Society, 72 Pitt Street, 6.30pm. For more information contact Catherine Rosenbrauer (02) 741 1961.

The Sorcerer User Group meets at the Greenwich Community Hall, Greenwich Road, Greenwich, every third Friday at 8pm. For more details contact: Sorcerer User Group, PO Box E162, St James NSW 2000. Telephone (02) 626 8020 (8pm-7am).

The Illawarra Cat User Group (ICUG) meets on the first Monday of each month at the Little Flower Church Hall, 2 Powell Street, West Wollongong, commencing at 7pm. More information may be obtained by writing to: ICUG, Secretary, Beth Cavallari, PO Box 14, Kiama NSW 2533. Telephone (042) 32 2534.

An Arcade & Adventure club has been formed catering for the Commodore 64 and 128 machines. For more information write to: John Eden Jnr, Lot 352, Bilinga Road, Kincumber NSW 2250. Telephone: (043) 69 3166.

For more details about the CAT User Group in Sydney, write to: CAT User Group, PO Box 120, Neutral Bay NSW 2089.

VICTORIA

The Turbo Pascal User Group has become the Turbo Special Interest Group of the Melbourne PC User Group. Meetings are held on the third Monday of each month at St Mark's Church, corner of Burke and Canterbury Roads, Camberwell, commencing at 7.30pm.

A new VZ-200/300 User Group has been formed. Interested readers should write to: VZ-200/300 User Group, PO Box 316, St Kilda Vic 3182.

TASMANIA

The Hobart Microbee User Group meets every second Wednesday of each month at the Clarence Emergency Services on the eastern shore of Hobart, commencing at 7.30pm. More information may be obtained by contacting: Frank Weston, Group Convenor (002) 47 9757 (AA) or the Secretary, Brian Links, 18 Tunah Street, Howrah Tas 7018.

A few changes have been made to the existing Tasmanian TI User Group. The group has a new Secretary/Treasurer, Elaine Shephard; and the group now meets at members' homes on a rotating basis. For more information write to: Tasmanian TI User Group, 1 Benboyd Court, Rokeby Tas 7019.

QUEENSLAND

The Ad Lib VeeZed Micro Club, previously based in Darwin, is now operating from Biggenden in Queensland. For more information contact: Ad Lib VeeZed Micro Club, 13 Brookes Street, Biggenden Qld 4621.

The Brisbane Spectravideo and MSX User Group meets every third Tuesday of each month at 25 Primrose Street, Woodridge, commencing at 7.30pm. For more details contact Lucille Parker (Secretary), 25 Primrose Street, Woodridge Qld 4114. Telephone (07) 208 5951.

WESTERN AUSTRALIA

The Amstrad User Group, Amswest meets on the first and third Tuesday of each month at 7.30pm, Shenton Park. For more details contact: Amswest, PO Box 1099, East Victoria Park WA 6101.

The BBC Teacher User Group holds meetings as requested at various schools in the Perth Metropolitan area. For more information contact: Drew Arbuckle, Director of Computing, Perth College, PO Box 25, Mt Lawley WA 6050; or Barney Clarkson, Director of Computing, Scotch College, 76 Shenton Road, Swanbourne WA 6010.

END

LAZING AROUND

Brain teasers courtesy of J J Clessa.

A continuous section of railway track is one mile long and fixed at both ends. It breaks in the middle and each half expands by one inch only. Assuming the middle goes up as it expands, how far off the ground will the mid point be. After you've made a guess — check your answer using a calculator.

Prize puzzle

Following one of his earlier victories, Napoleon arranged his soldiers to stand in a straight line in order of increasing seniority.

He walked down the line and gave each man a medal. He then returned to the start, located the second man with a medal and gave him, and every third man thereafter, another medal.

He returned to the start again, located the second man with two medals, and gave him, and every third man who also had two medals, another medal. He returned to the start again, located the second man with three medals, and gave him and every third man who also had three medals, another medal. And so on.

His most senior officer was the only one to get 10 medals. How many men had he?

Answers on postcards, please, or backs of envelopes, to reach us not later than 15 November 1986. Send your entries to Lazing Around, October Prize Puzzle, *APC*, 2nd Floor, 215 Clarence Street, Sydney 2000.

July prize puzzle

This was a fairly tough problem — although with a bit of work and patience, it was solvable on most PCs. However, only 46 entrants submitted solutions and rather than return to the controversy of whether 1 is a prime or not, we accepted either of the solutions:

1	7
41	67
241	467
2417	2467
62417	24671
862417	824671
9862417	9824671
98624173	98246713

Obviously all nine digits could not be used, since any number containing all nine digits would divide by nine.

The winning entry came from Mr J Cook of East Burwood, Victoria. Congratulations Mr Cook, your prize is on its way.

MICROCHESS

Kevin O'Connell reports on some surprises at the Fifth World Computer Chess Championship in Cologne.

The Fifth World Computer Chess Championship was played in Cologne, June 11-15. The event attracted 23 entries (more than ever before) and they spanned a greater range of hardware than in previous championships — from substantially more than $20,000,000 down to about $150.

The standard expectation was that Hitech would win. This was reinforced in the second round, when Hitech won the fine game which follows, while the reigning champion (and second seed) Cray Blitz was trounced by the unfancied Bobby. However, in the last round Hitech went astray against Cray Blitz, lost a pawn and was ground down in the ending. That final round upset gave Cray Blitz the best tie-break score and the title of world champion for an unprecedented second term.

Final results were: 1-4 Cray Blitz (USA), Hitech (USA), Bebe (USA), Sun Phoenix (Canada) 4 out of 5; 5-10 Rebel (Holland), Bobby (Germany), Plymate (Sweden), Mephisto (Germany), Dutch (Holland), Nona (Holland), 3; 11-13 Advance (England), Lachex (USA), Ostrich (Canada) 2½; 14-17 Schach (Germany), Cyrus (England), Vaxchess (England), Chat (Germany) 2; 18-20 BCP (England), Enterprise (Denmark), Awit (Canada); 21-22 Rex (USA), Shess (Holland) 1; 23 Kempelen Atari (Hungary) 0.

White: Hitech. Black: Schach 2.7. Opening: Sicilian Defence.

1	e2–e4	c7–c5
2	Ng1–f3	d7–d6
3	Bf1–c4	e7–e6
4	d2–d4	c5xd4
5	Nf3xd4	Ng8–f6
6	Nb1–c3	Bf8–e7
7	Bc1–e3	Nb8–d7
8	Qd1–d2	Nd7–e5
9	Bc4–32	0–0
10	h2–h3	

If White were a human playing against a computer, I would be certain that this move was played with the intention of following up with Nd4-f3; as it is, I find it hard to credit that a computer program could really institute such a subjective plan.

10	. . .	Bc8–d7
11	Nd4–f3	Ne5xf3+

Hitech suggested 11 . . . Ne5–c6 as

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Chessboard 2

Chessboard 3

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MICROCHESS

being better, and I agree.

12	g2xf3	Qd8–a5
13	0–0–0	Ra8–c8
14	Rh1–g1	

Hitech spent most of its time examining Kc1–b1, but then when it got down to 7 or 8-ply it switched to the text move which is very much stronger.

14	...	Rf8–e8
15	Be3–h6	g7–g6
16	Bh6–g5	Qa5–c5
17	Qd2–f4	Nf6–h5
18	Qf4–h4	f7–f6

18 ... Be7xg5 19 Rg1xg5 — this move also gives White a tremendous attack.

19	Bg5–e3	Qc5–a5
20	Be2–b5!	

A pretty example of 'interference' — blocking the fifth rank and interfering with the black queen's defence of the knight.

20	...	Bd7xb5
21	Qh4xh5	g6–g5
22	Be3xg5!	f6xg5
23	Rg1xg5+	
23	...	Kg8–h8

Or 23 ... Be7xg5 24 Qh5xg5+ Kg8–f7 (24 ... Kg8–h8 25 Qg5–f6+ and mate next move) 25 Nc3x b5, threating to win everything with Nb5xd6+, is impossible for Black; for example, 25 ... e6–e5 26 Nb5xd6+ Kf7–e6 27 Qg5–f5+ Ke6–e7 28 Qf5–f7+ Ke7–d8 29 Nd6xb7 mate.

24	Rd1–g1!	1–0 (Black resigns)

There is no adequate defence against the threat of 25 Qh5xh7+ followed by 26 Rg5—h5 mate, since 24 ... Be7×g5 25 Qh5×g5 Rc8–c7 26 Qg5–f6+ Rc7–g7 27 Qf6×g7 is also mate.

NUMBERS COUNT

Mike Mudge tackles divisor functions first posed by M Rumsey.

Definition of the Divisor Function: s(n) Given any positive integer, n, s(n) is defined to be the sum of all of the positive integers which divide exactly (no remainder) into n.

For example, s(98) = 1 + 2 + 7 + 14 + 49 + 98 = 171

s(p) = p + 1 where p is any prime number, which by definition is only divisible by itself and one.

In *Eureka*, volume 26, page 12, 1963, M Rumsey asked for solutions of the equation s(q) + s(r) = s(q + r) ... (i)

We now present a survey of some results relating to this equation.

Result A if q + r is prime, the only solution of (i) is: s(1) + s(2) = (s)3, that is, 1 + 3 = 4.

Result B If $q + r = p^2$, where p is a prime, then q is prime and $r = 2^n k^2$, where n and k are odd integers (or conversely, since (i) is symmetrical in q and r).

The case k = 1 leads to solutions when $p = 2^n - 1$ (that is, a Mersenne Prime — see for instance *A Concise Introduction to the Theory of Numbers* by Alan Baker, CUP 1986, for a detailed discussion of these particular primes provided that $q = p^2 - 2^n$ is also prime. Such solutions occur for n = 2, 3, 5, 7, 13 and 19. Among the values of n for which the question is, to the best of the author's knowledge, still open are 31, 61, 89, 107, 127, 607, 1279, 4253, 9941 and 11213.

There are no solutions to (i) under result B if k contains a factor which leaves remainder 3 when divided by 14.

The case k = 5 has been shown to yield no solutions except possibly when n = 189, 249, 501, 509, 521, 573, 585, 605, 621, 809, 845, 861, 873, 969 ...

The case k = 7 yields for: n = 1 the solution: s(5231) + s(98) = s(5329) — that is, 5232 + 171 = 5403.

n = 2 the solution:

s(213977) + s(392) = s(214369) — that is, 213978 + 855 = 214833 more easily displayed as s(213977) + $s(2^3.7^2) = s(463^2)$, the next values of n in doubt being 31, 33, 103, 115, 121, 123, 159, 169, 225, 255 ...

The case k = 11 yields for: n=1 the solution:

s(24407) + $s(2.11^2)$ = $s(157^2)$ n = 13 the solution;

s(1410646926617) + $s(2^{13}.11^2)$ = $s(1187707^2)$, the next values of n which are in doubt being 21, 45, 57, 67, 141, 145, 153, 163, 177, 193 ...

The case k = 13 has no known solutions. However, those values of n which are still in doubt commence 53, 55, 79, 91, 149, 163, 175, 187, 229, 277 ...

Other known solutions under result B include:

s(155015849) + $s(2^5.19^2)$ = $s(12451^2)$

s(1193399) + $s(2.5^4)$ = $s(1093^2)$

s(229405235369) + $s(2^9.5^4)$ = $s(478963^2)$

s(2676857975009) + $s(2^9.7^4)$ = $s(1636111^2)$

For n = 1 and k, prime solutions are known for k = 53, 137, 193 & 277, while for n = 3 with k = 313 & 421; also, for n = 5 with k = 97, 107, 131, 149 & 257 yield solutions.

Result C If $g + r = p^3$, where p is a prime, the solutions known to the author are s(2) = s(6) = s(8) — that is, (1+2) = (1+2+3+6) = (1+2+4+8); also s(11638687) + $s(2^2.13.1123)$ = $s(2227^3)$.

Readers are invited to write a program to evaluate the divisor function: s(n), ideally where n is either input as a general length integer or in terms of its prime factors; investigate solutions of Rumsey's equation (i) above, recovering some (or all!) of the given results, hopefully with some new ones; investigate a somewhat similar equation due to Leo Moser:

m s(m) = n s(n) ... (ii) where m and n are two unequal positive integers.

Note that m = 12 and n = 14 is a solution which in turn leads to an infinity of further solutions m = 12q and n = 14q where q and 42 have no common factor.

Attempts at the above may be submitted to: Mike Mudge, *C/- APC*, 2nd Floor, 215 Clarence Street, Sydney 2000, by 15 November 1986.

It would be appreciated if such submissions could contain a brief summary of results obtained and thoughts relating to the problem, in a form suitable for future publication in *APC*. These submissions will be judged using suitably vague criteria, and a prize will be awarded to the 'best' contribution received by the closing date.

Please note that submissions can only be returned if a suitable stamped addressed envelope is provided.

Mike Mudge welcomes correspondence on any subject within the areas of

NUMBERS COUNT

number theory and computationally-related mathematics, particularly containing suggested subject areas for future Numbers Count articles, and will endeavour to reply to all letters.

Markoff Numbers

This problem (*APC,* April) proved inexplicably popular; a Tandy Model 4P in Sydney yielded an ordered list of Markoff numbers up to 99999999.

Several regular contributors gave this problem a lot of attention, having found it to be 'fascinating', 'challenging' and readily amendable to programming in Basic or indeed any other high-level language.

This month's winner, after considerable thought, is John Scholes, who used an IBM PC. John follows a theoretical study with full program listings and a print-out of all Markoff Triples less than 10^{12}, there being 152 of them. His approach to the 'related Diophantine equation' yielded only eight solutions in an 18-hour search, the largest unknown found being 59. This was improved upon by several other contributors; indeed, one run of over 135 hours yielded two new solutions, (3,3,4,6,42,87) and (2,13,39,97,99).

There is still scope for an efficient search algorithm:
$5(p^2+q^7+r^2+s^2+t^2)^2 - 7(p^4+q^4+r^4+s^4+t^4) = 90pqrst$.

DIARY DATA

Readers are strongly advised to check details with exhibition organisers before making travel arrangements to avoid wasted journeys due to cancellations, printers' errors, etc.

Adelaide	Electronics '86 Contact: Australian Exhibition Services Pty Ltd Suite 3.3, 424 St Kilda Road Melbourne 3004 (03) 267 4500	October 7-9, 1986
Sydney	Office Automation Association of Australia Contact: City Tattersall Club, Sydney, 6-8pm	October 29, 1986
Sydney	Infotex '86 Contact: Richard May or Alan Tayt (02) 959 5555	November 4-6, 1986
Hong Kong	Software Exhibition '86 Contact: Nelson Tse, Tel: (3) 723 5656	November 4-6, 1986
Las Vegas, US	Comdex/Fall '86 Contact: Linda Yogel, Comdex/Fall '86, 300 First Avenue, Needham, Mass 02194, US Tel: (617) 449 6600	November 10-14, 1986
Montpellier, France	IDATE Contact: Bureaux du Polygone, Rue des Etatsdu-Languedoc, 34000, Montpellier, France Tel: 67 65 4848	November 17-19, 1986
Bangkok	SEARCC '86 Contact: TIG Australia Inc, 8 West St, Nth Sydney (02) 959 5555	November 17-21, 1986
Singapore	Automasia '86 Contact: Australian Exhibition Services, Suite 3.3, 424 St Kilda Road Melbourne 3004 (03) 267 4500	November 18-22, 1986

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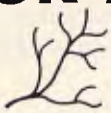

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Bounded	YES	NO	NO
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List Management:			
Mail	YES	NO	YES
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Sort	YES	NO	YES***
Select	YES	NO	NO
Interactive page preview	YES	NO	NO
Hyphenation	YES	NO	NO
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Multi-column text	YES	NO	NO
Printing:			
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BENCHMARKS

A list of Benchmarks used when evaluating micros is given below. An explanation can be found in the February '84 issue.

```
100 REM Benchmark 1
110 PRINT "S"
120 FOR K=1 TO 1000
130 NEXT K
140 PRINT "E"
150 END
```

```
100 REM Benchmark 2
110 PRINT "S"
120 K=0
130 K=K+1
140 IF K<1000 THEN 130
150 PRINT "E"
160 END
```

```
100 REM Benchmark 3
110 PRINT "S"
120 K=0
130 K=K+1
140 A=K/K*K+K-K
150 IF K<1000 THEN 130
160 PRINT "E"
170 END
```

```
100 REM Benchmark 4
110 PRINT "S"
120 K=0
130 K=K+1
140 A=K/2*3+4-5
150 K<1000 THEN 130
160 PRINT "E"
170 END
```

```
100 REM Benchmark 5
110 PRINT "S"
120 K=0
130 K=K+1
140 A=K/2*3+4-5
150 GOSUB 190
160 IF K<1000 THEN 130
170 PRINT "E"
180 END
190 RETURN
```

```
100 REM Benchmark 6
110 PRINT "S"
120 K=0
130 DIM M(5)
140 K=K+1
150 A=K/2*3+4-5
160 GUSUB220
170 FORL=1 TO 5
180 NEXTL
190 IF K<1000 THEN 140
200 PRINT "E"
210 END
220 RETURN
```

```
100 REM Benchmark7
110 PRINT "S"
120 K=0
130 DIM M(5)
140 K=K+1
150 A=K/2*3+4-5
160 GOSUB 230
170 FOR L=1 TO 5
180 M(L)=A
190 NEXTL
200 IF K<1000 THEN 140
210 PRINT "E"
220 END
230 RETURN
```

```
100 REM Benchmark 8
110 PRINT "S"
120 K=0
130 K=K+1
140 A=K  2
150 B=LOG(K)
160 C=SIN(K)
170 IF K<1000 THEN 130
180 PRINT "E"
190 END
```

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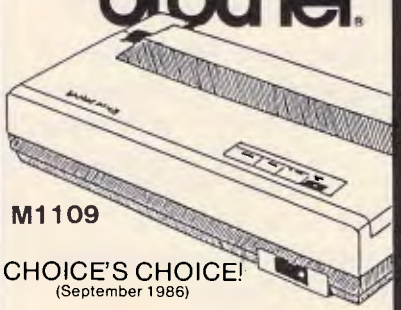

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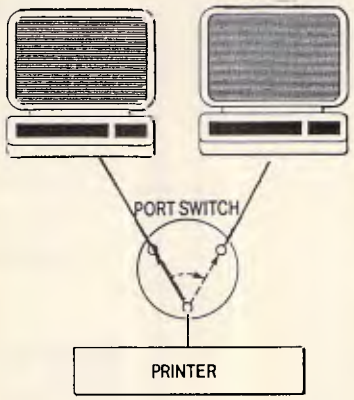

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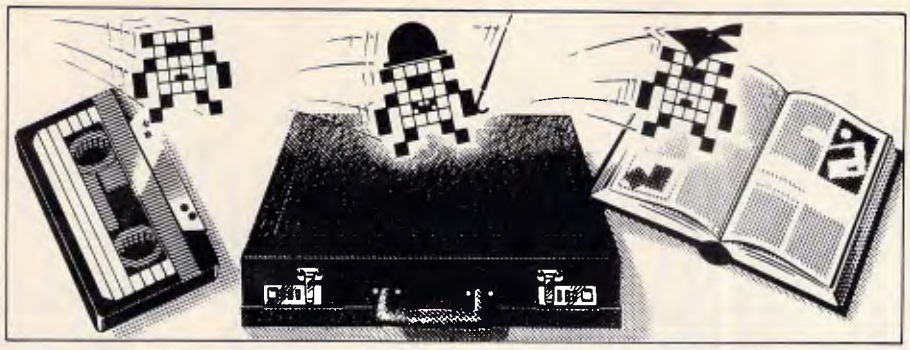

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Owen Linderholm selects the best of readers' programs. For details on submitting your own, see the end of this section.

In December 1985, 'Programs' published a program called Amsquill for the Amstrad CPC machines by Justin Moffitt. I recently received a letter from Justin explaining that he had an advanced version ready. As this will be primarily of interest to people who have already typed-in the original, I have arranged that anyone who is interested can get a listing and instructions. The address is: Amstrad Amsquill Advanced, c/o *APC*, 2nd Floor, 215 Clarence St, Sydney 2000. You *must* include an *SAE.*

Room for improvement

I have recently received suggestions as to how 'Program File' could be improved. The most common request is for us to supply cassette and disk versions of programs for a fee. Several magazines do this, but they are all machine-specific titles — they only need to make one cassette or disk which holds all the programs. Unfortunately, *APC* would have to make separate cassettes or disks for all the different machines for which we publish programs. The administrative and machine costs of doing this are just too much: we wouldn't be able to supply the programs at an even vaguely reasonable price.

Programs will, however, increasingly be available on Microtex 666. I'll try to make sure, where possible, that these are in both machine or language format and ASCII. This will make it easier for people to convert programs to other machines or even run them directly.

At the moment, I seem to be receiving different kinds of programs in 'fits and starts', which means that 'Program File' is starting to look less varied than it used to. For example, over the past couple of months, well over 20 versions of the Mandelbrot Set have been sent in. Initially I turned them down because I felt that this was a topic that had already been adequately covered elsewhere, but the huge numbers of these programs I have received has prompted me to publish one. I will wait for a good, simple and clear one for any machine, and then I'll feature it. (I'm writing this well in advance of the cover date, and will have received over a month's worth of programs by the time you read this, so don't set about writing a program for the Mandelbrot Set immediately).

I would like to stress that I am interested in all kinds of programs as long as they are novel, interesting and well-written. Please continue to improve the standards of documentation, since one of the purposes of 'Program File' is to help increase other people's understanding of programming. We are receiving fewer educational programs than I would like, so that is one area where experimentation would be welcome. Please remember, however, that teaching is a difficult profession, and educational programs don't work unless a lot of attention has been given to them.

This month's programs

This month's listings are a rather mixed bag. The Program of the Month is in Turbo Pascal for any machine that can run it (or even other Pascals). It is once again by Mark Needham who, at his current rate, will be able to make a full-time living out of 'Program File'. The program is a version of Micro Prolog but it does lack a few features, especially list processing. Nevertheless, it's a good introduction to Micro Prolog and also to the difficult field of writing programming languages.

The next program, for the Commodore 64, covers a topic which several readers' programs have covered previously, but none have been as comprehensive and well-researched as this one. The program produces a table of tape recorder counter readings for different playing times along a cassette, in 15-second intervals. It takes into account different makes of cassette and the fact that cassette recorders all differ physically from each other. The program can be applied to any form of cassette, even videotape; this should make it easier to keep track of large video or cassette libraries as well as computer programs on cassette.

As newer machines enter the market and the users of older ones become more experienced, languages other than Basic are being used more often; the final program is an example of that. It's written in C for an Atari ST. Unfortunately, as it's a game and relies heavily on graphics, it probably won't convert to other machines.

The program is a version of Breakout. It has one unusual feature in that the bat doesn't always hit the ball correctly when you move it very fast towards the ball, but I found that this made the game more interesting. As it's mouse-controlled, the bat moves vertically as well as horizontally.

A minor bludner occurred in Mark Needham's 6502 emulator (*APC*, August). On the left-hand side of page 169, about halfway down, there's a CASE statement. One of the options is missing — it should be a space between single quotes.

Remember: all submissions to Program File should be accompanied by a stamped, addressed envelope.

Program of the Month
Turbo Pascal LOGIPROG

MICROTEX 666

This program is available electronically through Microtex 666's software downloading service. It is accessed through Viatel page *66637#

by Mark Needham

LOGIPROG is a cut-down version of Micro Prolog, a language that is now becoming available for some of the more popular home micros. The only major differences between Micro Prolog and LOGIPROG are the omission of an editor and lists in variables. LOGIPROG was written on a 256k IBM Portable in Turbo Pascal. None of the special IBM goodies are used, so the program should run on any MS-DOS machine.

If you want to read about Prolog, I recommend *Learning Micro Prolog* by Tom Conlon. I used this book as a reference while writing LOGIPROG, and all the examples that don't use lists should work.

To run LOGIPROG, type the program in and compile it to disk. To run the program, type LOGIPROG. A one-line heading and the prompt '&' will appear; the LOGIPROG interpreter is now ready to be used.

Prolog is a language unlike any of the current languages in that facts and questions are entered in an almost English form. For example:
eats(John fish) — specifies the fact that John eats fish
talks(Jim) — specifies the fact that Jim talks
travels—between(Fred Geelong Melbourne) — Fred travels from Geelong to Melbourne

The first word (usually a verb) is called a 'predicate' and the words in the brackets are called 'arguments'. The first three examples are examples of facts which can be entered into the LOGIPROG database. Facts come in three forms, depending on the number of arguments:
Prefix: these facts have three arguments and can only be written in one format — for example, travels-from-to(Fred Melbourne Bendigo)
Infix: these facts have two arguments and can be written in two different formats — for example, eats(John fish) and John eats fish
Postfix: these facts have only one argument, and like Infix facts can be written in two formats — talks(Jim) and Jim talks

As well as straightforward facts, rules can be entered into the LOGIPROG database. To specify the rule that John is healthy if John eats fish, the rule below can be used:
healthy(John) if eats(John fish) or John healthy if John eats fish

Upper and lower case words are different. For example, 'John' is not the same as 'john'.

Adding facts and rules to Logiprog

To add facts and rules to the database, use the ADD command:
add(eats(John fish)) or add(John eats fish)
add(talks(Jim)) or add(Jim talks)

As the order of facts or rules in the database can affect the outcome of a result, the ADD command has an optional parameter which specifies where the fact or rule will be placed. For example, if the database already contains the above 'eats' fact, and a new 'eats' fact needs to be entered before it, type:
add 1 (eats(Fred bread))

Listing the database contents

To list the entire database enter . . . list or list all
To list only the eats facts and rules enter . . . list eats

When the facts and rules are listed, all those with the same predicate will be lumped together. The order of the individual facts and rules for each predicate are listed in the order in which they were entered, or positioned using the optional parameter in the ADD command. If the above three rules were entered, the list would look like this:
Fred eats bread
John eats fish

Jim talks

Deleting facts and rules from LOGIPROG

Deleting facts and rules can be done in several ways. The DELETE command can delete one occurrence of a predicate. The KILL command can delete all ocurrences of a predicate or all the facts in the current database. For example:
To delete the first eats fact or rule enter . . . delete eats 1
To delete all eats facts and rules enter . . . kill eats
To delete the whole database enter . . . kill all

Loading and saving the database

To save all the facts and rules currently in memory, use the SAVE command. The only parameter required is the filename. To load a database, use the LOAD command. The load also requires the filename and will first check that the files are on disk. To keep the program as short as possible there's no filename validation, so be careful to use only legal filenames.

Other commands

To end the program, type BYE. If you have entered facts or rules but have not saved them, you will be asked if you want to finish or not. To see the current status of the database, type STATUS or STAT.

Variables in LOGIPROG

It's useful in rules to put variables instead of words or numbers:
x healthy if x eats fish — this rule applies to anyone eating fish

Variables are x,x1,x2 . . . x9,y,y1 . . . y9,z,z1 . . . z9, X,X1 . . . X9,Y,Y1 . . . Y9,Z.Z1 . . . Z9. Again, notice that x and X are different variables. Variables can be undefined or contain a numeric value or a text string.

Special predefined predicates

There are several predefined predicates that can be placed as conditions in the rules. These predicates *must* be in upper case.
SUM(x y z) — this predicate can be used to check that the first two arguments add up to the third, or if one of the arguments is undefined, it will be calculated and always be true. For example:
SUM(1 2 3) returns true
SUM(10 -1 11) returns false
if x is undefined SUM(1 2 x) makes x=3
if y=20 and x is undefined SUM(x 1 y) makes x=19
TIMES(x y z) — like the SUM command, TIMES can be used to check that the first and second arguments multiplied together make the third, or if one of the arguments is undefined, it will be calculated. For example:
TIMES(10 0.5 5) returns true
TIMES(12 2 6) returns false
if x1 is undefined TIMES(2 x1 12) makes x1=6
if y2=10 and z is undefined TIMES(2 y2 z) makes z=20
P() & PP() — these two functions are like PRINT in Basic. Everything between the brackets will be printed. Any variables will be substituted with their values. The only difference between P and PP is that PP does a CR LF after it, P does not. Both return true. For example:
if x=Fred P(hello x) would display hello Fred

R(x) —like the INPUT routine in Basic, this will get a value from the keyboard and assign it to the specified variable. Like PP & P, this always returns true.
x LESS y — this returns true if the value of x is less than y, otherwise it returns false. Both arguments must have a value, or an error will occur. For example:
10 LESS 20 returns true
if x is 12 x LESS 10 returns false
x EQ y — this function has two modes. If both x and y have values, the function will return true if x=y, and false if x oy. If one of the arguments is an undefined variable, that variable will be assigned the value of the other argument and true will be returned. For example:
Fred EQ fred returns false (upper and lower case)
if x is undefined x EQ 100 makes x = 100
x INT — this returns true if x is an integer, false if not. For example:
20.2 INT returns false
if y1=12 y1 INT returns true
x INT y — like the INT() function in Basic, this assigns the second argument with the integer value of the first. This always returns true. For example:
if z2 is 5.4 z2 INT z3 makes z3=5
20.1 INT z makes z=20

Local variables and recursive rules

The values contained in the variables are local to each rule. When a new rule has to be processed, all the currently-defined variables are put on the variable stack and all variables are cleared out. This allows rules to have themselves as one of their conditions and LOGIPROG to work recursively. The only problem is that recursive rules need a lot of memory, and too many recursive calls will cause an OUT OF MEMORY error or the program to crash, so be careful.

Asking LOGIPROG questions

There are two ways of getting information from LOGIPROG.
(1) IS questions: this command will search the current database and check that the conditions specified can be confirmed or not. If all conditions can be met it will return YES, if not it will return NO. If a fact cannot be confirmed, LOGIPROG assumes that fact is false. For example, using the three facts defined so far:
IS(Fred eats bread) returns YES
IS(John talks) returns NO
IS(Fred eats bread & Jim talks) returns YES

Notice in the last example the '&'. This means that both the first condition *and* the second condition must be true for the whole to be true.
(2) WHICH questions: this is more useful than the IS question as LOGIPROG will return answers that fit the conditions specified. For example, again using the three defined facts:
which(x:x eats bread) — this is saying 'find all replacements for x where x eats bread'

LOGIPROG returns:
Fred
No (more) answers

which(z1 z2 : z1 eats z2) — this is saying 'find all replacements for z1 and z2 where z1 eats z2'

LOGIPROG returns:
Fred bread
John fish
No (more) answers

To make the answer more readable, a sentence can be specified:
which(y is eaten by x : x eats y) returns
bread is eaten by Fred
fish is eaten by John
No (more) answers

It doesn't matter which variables you use, as all variables are local to each rule; only the values of the variables are passed from one rule to the next.

More than one condition can be specified in both the IS and WHICH questions.

LOGIPROG example database

Add all the following facts and rules into LOGIPROG using the ADD command. If you make a mistake, use the DELETE command to erase the fact and retype it.
Fred normal–rate 1.50
Jim normal–rate 1.25
Helen normal–rate 1.28
Sam normal–rate 1.30

Fred overtime–rate 2.50
Jim overtime–rate 1.80
Helen overtime–rate 2.20
Sam overtime–rate 1.70

Fred age 25
Jim age 70
Helen age 21
Same age 45

z1 retired if z1 age z2 & 64 LESS z2
x normal–hours y if PP(Enter hours worked by x) & R(y)
x overtime–hours y if PP(Enter overtime worked by x) & R(y)
X greater–than Y if not X LESS Y & not X EQ Y
x wages–is y if x normal–hours z1 & x normal–rate z2 & TIMES(z1 z2 z3) & x overtime–hours z4 & x overtime–rate z5 &
TIMES(z4 z5 z6) & SUM(z6 z3 y)

As you can see, the last rule is far too long to fit on one line. To overcome this, you can press Return after entering every condition. LOGIPROG counts the number of opening and closing brackets and only finishes the input when the number of opening brackets equals the number of closing brackets.

Also notice the NOTs in the greater-than rule. The NOT reverses the result of the condition.

Now you can interrogate the database.

(1) Who is retired?
which (z : z retired)
(2) Whose normal rate is greater than 1.30?
which(x1 : x1 normal–rate y & y greater–than 1.30)
(3) What is Fred wage?
which(X : Fred wages–is X)

```
program LOGIPROG;      { Simplified version of MICRO PROLOG in TURBO PASCAL. }

type
  Modes       = (Prefix,Infix,Postfix);  { Define 3 types of Fact          }
  SearchMode  = (None,Which,Is);         { Define Search modes             }
  Strfield    = string[80];              { Define normal & long strings    }
  LongStr     = string[255];
  PtrTypes    = (Undefed,VarPtr,NumPtr,TextPtr);   { Define Argument Types }
  ArgDef      = record
                  AType : PtrTypes;      { The Argument Type   }
                  AVal  : Real;          { Numeric Value       }
                  APtr  : integer        { Pointer to Text     }
                end;
  FactType    = record
                  Negative  : boolean;   { True if NOT infront          }
                  SentMode  : Modes;     { Mode Prefix,Infix,PostFix    }
                  Predicate : integer;   { Ptr to Predicate Text        }
                  ArgInfo   : array[1..3] of ArgDef;  { Argument Info }
                  RulePtr   : integer    { Ptr to Next Condition        }
                end;
  StackType   = record
                  VarNum     : integer;     { Variable Number }
                  VarDetails : ArgDef       { Variable Contents Info }
                end;
  CondArray   = array[1..15] of FactType;  { Conditions array definition }
  CharDef     = record CDef : char end;    { Record for files           }
  OutModes    = (Screen,Stack);
```

```
const
  VarChars = 'xyzXYZ'; {Variables x x1..x9 y y1..y9 z z1..z9 X X1..X9 etc }
  ArgNums  : array[Prefix .. Postfix] of integer = (3,2,1);

var
  NextFact,NextCond,loop,ErNum,BrackOn,PredPtr,ArgPtr,
  LastSpecial,SUMPtr,TIMESPtr,INTPtr,LESSPtr,EQPtr,PPtr,
  PPPtr,RPtr,StackPtr,NumOfConds  : integer;
  ProgExit,GlobEr,Change          : boolean;
  ComStr,WhichStr,CurFileName     : LongStr;
  ER                              : array[1..20] of strfield;
  NewSent          : FactType;
  NewArg           : ArgDef;
  NumFile          : Text;                    { File type definitions }
  SentFile         : file of FactType;
  CharFile         : File of Chardef;
  CharRec          : CharDef;
  StackVar         : StackType;               { Used for Variables on Stack }
  Conds            : CondArray;
  Variables        : array[0..60] of ArgDef;
  Facts            : array[1..200] of FactType;      { User Entered Facts
  Conditions       : array[1..200] of FactType;      { & Their Conditions
  Preds            : array[1..4000] of char;         { Predicates defined
  Args             : array[1..4000] of char;         { Arguments defined
  VarStack         : array[1..400] of StackType;     { Variable Stack

PROCEDURE ClearVariables;  { As it says - This clears all variables out }
var loop : integer;
begin for loop := 0 to 60 do Variables[loop].AType := Undefed end;

PROCEDURE PushStack(s : StackType);  { Place data on the stack (MAX 400) }
begin
  VarStack[StackPtr] := s; StackPtr := succ(StackPtr);
  if StackPtr > 399 then begin GlobEr := true; ErNum := 7 end
end;
PROCEDURE Spaces(n : integer; var s : strfield); { Pad string with spaces }
var loop : integer;
begin s[0] := chr(n); for loop := 1 to n do s[loop] := ' ' end;

PROCEDURE InitData;  { Set up all pointers and initial values }

  PROCEDURE SavePred(w : Strfield);   { Save a special Predicate }
  begin
    for loop := 1 to length(w) do
      begin Preds[PredPtr] := w[loop]; PredPtr := succ(PredPtr) end
  end;

begin
  writeln('LogProg - Logic Programming by Mark Needham (June 1986)');
  writeln;
  Change := false;
  CurFileName := '';
  PredPtr := 1;          { Pointer to next free space in Predicate list }
  ArgPtr := 1;           { Pointer to Argument list                     }
  NextFact := 1;         { Next free Fact in Facts                      }
  NextCond := 1;         { Next free condition                          }
  ClearVariables;        { Clear out all variable details               }

  ER[1] := 'Syntax Error';          { Set up Error messages (ErNum)     }
  ER[2] := 'Unknown Command';
  ER[3] := 'Number or ( after "add" expected';
  ER[4] := 'Unknown Predicate';
  ER[5] := 'Fact Not Found';
  ER[6] := 'File Not Found';
  ER[7] := 'Out of Memory';
  ER[8] := 'Too Many Unknowns';

  SUMPtr := PredPtr;
  SavePred('SUM ');     { SUM(x y z)   used for Addition & Subtraction    }
  TIMESPtr := PredPtr;
  SavePred('TIMES ');   { TIMES(x y z) used for multiplication & division }
  INTPtr := PredPtr;
  SavePred('INT ');     { INT(x)       used to check an integer           }
  LESSPtr := PredPtr;
  SavePred('LESS ');    { x INT y      makes y the integer value of x     }
  EQPtr := PredPtr;
  SavePred('EQ ');      { x EQ y       checks x=y or sets var=to other var}
  PPtr := PredPtr;
  SavePred('P ');       { P(text x)    displays text and values           }
  PPPtr := PredPtr;
  SavePred('PP ');      { PP(text x)   displays text and values + CR LF   }
  RPtr := PredPtr;
  SavePred('R ');       { R(x)         read value for x from keyboard     }
  LastSpecial := PredPtr  { Start of user defined Predicates }
end;

FUNCTION GetYesOrNo(m : Strfield) : boolean;  { Wait for a 'Y' or 'N' }
var ch : char;
begin
  write(m,  (Y)es or (N)o ? ');
  repeat read(kbd,ch); ch := UpCase(Ch) until (ch = 'Y') or (Ch = 'N');
  writeln; GetYesOrNo := (ch = 'Y')
end;

FUNCTION CheckCh(ch : char) : boolean;
begin CheckCh := ((ch=' ') or (ch='(') or (ch=')')) end;

FUNCTION CheckForVar(x : strfield) : boolean;
begin
  CheckForVar := ((length(x)=1) and (pos(x,VarChars)<>0)) or
                 ((length(x)=2) and (pos(x[1],VarChars)<>0) and
                 (pos(x[2],'123456789')<>0))
end;

FUNCTION CheckForReal(x : strfield) : boolean;
var n : real; ner : integer;
begin val(x,n,ner); CheckForReal := (ner = 0) end;

FUNCTION ConvVarToNum(x : strfield) : integer; { Convert Variable > 0..59 }
var t : integer;                               { x = 0,x1 = 1,y = 10 etc  }
begin
  t := (pos(x[1],VarChars)-1)*10; if length(x)=2 then t := t + (ord(x[2])-48);
  ConvVarToNum := t
end;

FUNCTION ConvNumToVar(n : integer) : Strfield; { Opposite of last }
var t : strfield;
begin
  t := VarChars; t := t[(n div 10)+1];
  if (n mod 10)<>0 then t := t + chr(48 + (n mod 10));
  ConvNumToVar := t
end;

FUNCTION ConvToReal(x : strfield) : real;  var n : real; ner : integer;
begin val(x,n,ner); ConvToReal := n end;

FUNCTION StripSpace(St : LongStr) : LongStr;
begin
  while (St[1] = ' ') and (length(St) > 0) do delete(St,1,1);
  if St <> '' then
    while (St[ord(St[0])] = ' ') do St[0] := chr(pred(ord(St[0])));
    StripSpace := St
end;

FUNCTION ReadFromTerm : Longstr;
var InpStr,TempStr : LongStr; ch : integer;

  FUNCTION CheckBrackets : boolean;  { Make sure brackets balance }
  begin
    BrackOn := 0;
    for ch := 1 to length(InpStr) do
      case InpStr[ch] of
        '(' : BrackOn := succ(BrackOn);
        ')' : BrackOn := pred(BrackOn)
      end;
    CheckBrackets := (BrackOn <= 0)
  end;

  PROCEDURE StripMulti(a : strfield);  { Get rid of spaces near brackets }
  begin
    ch := pos(a,InpStr);
    while ch<>0 do begin delete(InpStr,ch,1); ch := pos(a,InpStr) end
  end;

begin  { ReadFromTerm funtion }
  InpStr := ''; BrackOn := 0;
  repeat
    repeat
      if BrackOn <> 0 then write(BrackOn) else write('& );
      write('. '); readln(TempStr);
      TempStr := TempStr + ' ';  InpStr := InpStr + TempStr
    until CheckBrackets;
    InpStr := StripSpace(InpStr)
  until InpStr <> '';
  StripMulti('  '); StripMulti(' ('); StripMulti(') ');
  ch := pos('(',InpStr);
```

```
  while ch<>0 do begin delete(InpStr,succ(ch),1); ch := pos('  ',InpStr) end;
  ReadFromTerm := StripSpace(InpStr)
end;

FUNCTION ToUpper(St : LongStr) : LongStr;  { Convert string to Upper case }
var l : integer;
begin for l := 1 to length(St) do St[l] := UpCase(St[l]); ToUpper := St end;

FUNCTION OverSpaces(t : LongStr) : LongStr;  { Delete leading spaces }
begin
  while (t[1]=' ') and (length(t)>0) do delete(t,1,1); OverSpaces:=t
end;

PROCEDURE skip(n : integer); begin if n<>0 then delete(ComStr,1,n) end;

FUNCTION GetUpToChar(check : char) : strfield;  { Extract string from front }
var t : strfield; x : integer;
begin
  t := ''; x := 1;
  while (ComStr[x] <> check) and (x < length(ComStr)) do
    begin t := t + ComStr[x]; x := succ(x) end;
  if x = length(ComStr) then ComStr := '' else skip(pred(x));
  GetUpToChar := t
end;

FUNCTION GetPredNum(w : LongStr) : integer;  { Return Predicate number      }
var loop,ch : integer; Found,ok : boolean;   { Value 0 if not already known }
begin
  loop := 1; Found := false;
  while not(Found) and (loop < PredPtr) do
  begin
    ok := true;
    for ch:=1 to length(w) do if Preds[loop+pred(ch)]<>w[ch] then ok:=false;
    if ok then Found := true
    else
    begin
      repeat loop := succ(loop) until Preds[loop]=' '; loop := succ(loop)
    end
  end;
  if Found then GetPredNum := loop else GetPredNum := 0
end;

FUNCTION GetArgNum(w : LongStr) : integer; { Return Arg Number for string }
var loop,ch : integer; Found,ok : boolean; { Return 0 if unknown          }
begin
  loop := 1; Found := false;
  while not(Found) and (loop < ArgPtr) do
  begin
    ok := true;
    for ch:=1 to length(w) do if Args[loop+pred(ch)]<>w[ch] then ok := false;
    if ok then Found := true
    else
    begin
      repeat loop := succ(loop) until Args[loop]='$'; loop := succ(loop)
    end
  end;
  if Found then GetArgNum := loop else GetArgNum := 0
end;

FUNCTION SaveArg(w : LongStr) : integer;  { Save new Argument and return }
var Found,ok : boolean;                   { its location                 }
    Ptr,ch : integer;
begin
  w := w + '$'; Found := false;
  if ArgPtr <> 1 then begin loop := GetArgNum(w); Found := (loop <> 0) end;
  if Found then SaveArg := loop
  else
  begin
    SaveArg := ArgPtr;
    for loop := 1 to length(w) do
      begin Args[ArgPtr] := w[loop]; ArgPtr := succ(ArgPtr) end
  end
end;

PROCEDURE GetParams(t : LongStr);     { Convert t to 1..3 Arguments and the }
var p,a1,a2,a3,w1,w2,w3 : Longstr;    { predicate and Mode }
    loop : integer; ch   : char; SpecialPred : boolean;

  FUNCTIDN SavePred(w : LongStr) : integer;   { Save the predicate and   }
  var Found,ok : boolean;                     { return its location      }
      Ptr,ch : integer;
  begin
    w := w + ' '; Found := false;
    if PredPtr <> 1 then
    begin loop := GetPredNum(w); Found := (loop <> 0) end;
    if Found then SavePred := loop
    else
    begin
      SavePred := PredPtr;
      for loop := 1 to length(w) do
        begin Preds[PredPtr] := w[loop]; PredPtr := succ(PredPtr) end
    end
  end;

  PROCEDURE SaveArgument(x : LongStr);
  begin
    if CheckForVar(x) then
    begin NewArg.AType := VarPtr; NewArg.APtr  := ConvVarToNum(x) end
    else
    if CheckForReal(x) then
      begin NewArg.Atype := NumPtr; NewArg.AVal := ConvToReal(x) end
    else
      begin NewArg.AType := TextPtr; NewArg.APtr  := SaveArg(x) end
  end;

  FUNCTION GetWord : LongStr;  { Get next word from t }
  var c : integer; ch : char;
  begin
    c := 0;
    repeat c := succ(c); ch := t[c]; until (c=length(t)) or CheckCh(ch);
    if (c=length(t)) and not(CheckCh(ch)) then begin GetWord:=t; t := '' end
    else
    begin
      GetWord := copy(t,1,pred(c)); delete(t,1,c); t := OverSpaces(t)
    end
  end;

begin
  w1 := ''; w2 := ''; w3 := ''; a1 := ''; a2 := ''; a3 := '';
  SpecialPred := false;
  with NewSent do
  begin
    Negative := false;            { clear negative flag (NOT) }
    for loop := 1 to 3 do
      begin ArgInfo[loop].AType := Undefed; ArgInfo[loop].APtr := 0 end;
    RulePtr := 0
  end;
  if pos('(',t) <> 0 then           { Check for syntax mode }
    begin
      p := StripSpace(GetWord);     { Get predicate         }
      if ToUpper(p) = 'NOT' then
        begin NewSent.Negative := true; p := GetWord end;
      t := OverSpaces(t);

    if (p = 'P') or (p = 'PP') or (p = 'R') then
    begin
      a1 := copy(t,1,pred(pos(')',t))); if a1='' then a1:= ' ';
      NewSent.SentMode := PostFix; SpecialPred := true
    end
    else                            { Get Arguments and determine mode }
    begin
      a1 := GetWord; a2 := GetWord; a3 := GetWord;
      if (a1<>'') and (a2<>'') and (a3<>'') then NewSent.SentMode := PreFix
      else
        if (a1<>'') and (a2<>'') then NewSent.SentMode := InFix
        else
          if a1<>'' then NewSent.SentMode := PostFix else ErNum := 1
    end
  end
else
  begin
    w1 := GetWord;                  { get words then decide what mode }
    if ToUpper(w1) = 'NOT' then
    begin NewSent.Negative := true; w1 := GetWord end;
    w2 := GetWord; w3 := GetWord;
    if (w1<>'') and (w2<>'') and (w3<>'') then
    begin p := w2; a1 := w1; a2 := w3; NewSent.SentMode := InFix end
    else
      if (w1<>'') and (w2<>'') then
        begin  p := w2; a1 := w1; NewSent.SentMode := PostFix end
      else ErNum := 1
  end;
if ErNum = 0 then
begin
  NewSent.Predicate := SavePred(p);
  if SpecialPred then
    begin NewArg.AType := TextPtr; NewArg.APtr  := SaveArg(a1) end
```

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```
      else SaveArgument(a1);
      NewSent.ArgInfo[1] := NewArg;
      if a2<>'' then begin SaveArgument(a2); NewSent.ArgInfo[2] := NewArg end;
      if a3<>'' then begin SaveArgument(a3); NewSent.ArgInfo[3] := NewArg end;
    end
  end;

  FUNCTION GetWord : LongStr;  { get next word from ComStr }
  var c : integer; ch : char;
  begin
    c := 0;
    repeat c := succ(c); ch := ComStr[c];
    until (c = length(ComStr)) or CheckCh(ch);
    if (c = length(ComStr)) and not(CheckCh(ch)) then
      begin GetWord := ComStr; ComStr := '' end
    else
      begin
        GetWord := copy(ComStr,1,pred(c));
        delete(ComStr,1,c); ComStr := OverSpaces(ComStr)
      end
  end;

  PROCEDURE DoAdd;   { Add a new Fact to the database }
  var num                    : strfield;
      c,n,ner,CondPtr,ExtraPtr : integer;
      temp,CondStr,ExtraStr    : LongStr;

    PROCEDURE AddOnEnd;
    begin Facts[NextFact] := NewSent; NextFact := succ(NextFact) end;

  begin
    Change := true; skip(3);              { skip over ADD }
    num := StripSpace(GetUpToChar('('));  { Get an optional number for the }
    if ComStr = '' then ErNum := 1        { location of the new Fact       }
    else
    begin
      ner := 0; if num = '' then n := 0 else val(num,n,ner);
      if ner <> 0 then ErNum := 3
      else
      begin
        skip(1);                                    { skip over '(' }
        CondPtr := pos(' IF ',ToUpper(ComStr));     { Check for start of conds }
        if CondPtr <> 0 then
        begin
          CondStr := copy(ComStr,CondPtr,255);
          ComStr := copy(ComStr,1,pred(CondPtr));
        end;
        GetParams(OverSpaces(ComStr));
        if CondPtr <> 0 then NewSent.RulePtr := NextCond;
        if n = 0 then AddOnEnd
        else
        begin          { find position for new Fact if not on end }
          c := 0;
          repeat
            c := succ(c);
            if Facts[c].Predicate = NewSent.Predicate then n := pred(n)
          until (n = 0) or (c = NextFact);
          if c = NextFact then AddOnEnd
          else
          begin                                  { move all down to make room }
            for loop := NextFact downto c do Facts[succ(loop)] := Facts[loop];
            Facts[c] := NewSent; NextFact := succ(NextFact)
          end
        end;
        if CondPtr <> 0 then
        begin
          repeat
            ComStr := OverSpaces(CondStr); temp := GetWord;  { skip IF or & }
            ExtraPtr := pos('&',ComStr);
            if ExtraPtr <> 0 then                          { add all conditions }
            begin                                          { to condition array }
              CondStr := copy(ComStr,ExtraPtr,255);
              ComStr := copy(ComStr,1,pred(ExtraPtr))
            end;
            GetParams(OverSpaces(ComStr));
            If ExtraPtr <> 0 then NewSent.RulePtr := succ(NextCond);
            Conditions[NextCond] := NewSent; NextCond := succ(NextCond)
          until ExtraPtr = 0
        end
      end
    end
  end;

  FUNCTION RetPred(n : integer) : LongStr;  { Return Predicate string }
  var t : LongStr;
  begin
    t:=''; repeat t:=t+Preds[n]; n:=succ(n) until Preds[n]=' '; RetPred:=t
  end;

  FUNCTION RetArg(n : integer) : LongStr;   { Return Argument string }
  var t : LongStr;
  begin
    t:=''; while Args[n]<>'$' do begin t:=t+Args[n]; n:=succ(n) end; RetArg:=t
  end;

  FUNCTION Display(x : ArgDef) : Longstr; { Display Argument's Value }
  var s : strfield;
  begin
    case x.AType of
    Undefed : Display := 'UNDEFINED';
    VarPtr  : Display := ConvNumToVar(x.APtr);
    NumPtr  : begin str(x.Aval:10:2,s); Display := StripSpace(s) end;
    TextPtr : Display := RetArg(x.APtr);
    end
  end;

  PROCEDURE List;                    { List all or specified Facts }
  var test : integer; t : LongStr;

    FUNCTION Displayit(x : FactType) : LongStr;
    var NegStr : strfield;
    begin
      with x do
      begin
        if Negative then NegStr := 'NOT ' else NegStr := '';
        case SentMode of
        PreFix  : Displayit := NegStr+RetPred(Predicate)+'('+
                               Display(ArgInfo[1])+' '+
                               Display(ArgInfo[2])+' '+Display(ArgInfo[3])+')';
        InFix   : Displayit := NegStr+Display(ArgInfo[1])+' '+
                               RetPred(Predicate)+' '+Display(ArgInfo[2]);
        PostFix : Displayit := NegStr+Display(ArgInfo[1])+' '+
                               RetPred(Predicate)
        end
      end
    end;

    PROCEDURE Spaces(n : integer);
    var loop : integer; begin for loop := 1 to n do write(' ') end;

    PROCEDURE DoList;
    var rule,len,TempPred : integer; l : LongStr; TempInfo : ArgDef;
    begin
      for loop := 1 to pred(NextFact) do
        if Facts[loop].Predicate = test then
        begin
          l := Displayit(Facts[loop]); write(l); len := length(l);
          if Facts[loop].RulePtr <> 0 then
          begin
            write(' if '); rule := Facts[loop].RulePtr;
            repeat
              TempPred := Conditions[Rule].Predicate;
              TempInfo := Conditions[Rule].ArgInfo[1];
              if TempPred = PPtr then write('P(',Display(TempInfo),')')
              else
                if TempPred = PPPtr then write('PP(',Display(TempInfo),')')
                else
                  if TempPred = RPtr then write('R(',Display(TempInfo),')')
                  else write(Displayit(Conditions[Rule]));
              rule := Conditions[Rule].RulePtr;
              if rule <> 0 then begin writeln(' &'); spaces(len+4) end
            until Rule = 0;
            writeln
          end else writeln
        end;
    end;

  begin   { List Procedure }
    if NextFact = 1 then begin writeln('No Facts'); writeln end
    else
    begin
      skip(5);
      if (ComStr<>'') and (ToUpper(ComStr)<>'ALL') then
        begin
          test := GetPredNum(ComStr+' ');
```

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```
            if test<>0 then DoList else ErNum := 4;
            writeln
          end
        else
          begin
            test := LastSpecial;
            repeat
              DoList; writeln; repeat test := succ(test) until Preds[test] = ' ';
              test := succ(test)
            until test = PredPtr
          end
      end
    end;

    PROCEDURE DoPrint(t : LongStr; SorS : OutModes);
    var w : LongStr; lastptr,wptr,loop,er : integer; ExtraSpace : boolean;
    begin
     t := t + ' '; ExtraSpace := false; wptr := 0; lastPtr := 1;
     while wptr < length(t) do
     begin
       repeat wptr := succ(wptr) until t[wptr] = ' ';
       w := copy(t,lastptr,wptr-lastptr);
       wptr := succ(wptr); lastptr := wptr;
       if ExtraSpace and (SorS = Screen) then write(' ');
       if CheckForVar(w) then
       case SorS of
         Screen : write(Display(Variables[ConvVarToNum(w)]));
         Stack  : begin
                    StackVar.VarNum := ConvVarToNum(w);
                    StackVar.VarDetails := Variables[ConvVarToNum(w)];
                    PushStack(StackVar)
                  end
       end ( Case )
       else
       begin
         if w[1] = chr(255) then  ( Got to pass back a text argument )
         begin
           StackVar.VarNum := ord(w[2]);
           StackVar.VarDetails.AType := TextPtr;
           StackVar.VarDetails.AVal := 0;
           val(copy(w,3,255),StackVar.VarDetails.APtr,er);
           PushStack(StackVar)
         end
         else
         if w[1] = chr(254) then  ( Got to pass back a numeric argument )
         begin
           StackVar.VarNum := ord(w[2]);
           StackVar.VarDetails.AType := NumPtr;
           val(copy(w,3,255),StackVar.VarDetails.AVal,er);
           StackVar.VarDetails.APtr := 0; PushStack(StackVar)
         end
         else
         if SorS = Screen then
           for loop := 1 to length(w) do if w[loop] <> '"' then write(w[loop])
       end;
       ExtraSpace := true
     end
    end;

    ( Main Evaluate Routine ( Unbelievably recursive !! )  )

    FUNCTION Eval(EvalType : SearchMode; TestCond : CondArray;
                  StartCond,num : integer) : boolean;

    var Sloop,condPtr,
        CPtr,count,PredVal : integer; FFound,Fail : boolean; Value : Real;
      PassVars : array[1..3] of ArgDet; tempArray : CondArray;

    PROCEDURE PushVars; var loop : integer;  ( Put vars with value on stack )
    begin
      StackVar.VarNum := -1;  PushStack(StackVar);
      for loop := 0 to 60 do
        if Variables[loop].AType <> Undefmd then
        begin
          StackVar.VarNum := loop; StackVar.VarDetails := Variables[loop];
          PushStack(StackVar);
        end
    end;

    PROCEDURE PullVars;  ( Get all variables off stack up to a -1 )
    begin
      ClearVariables; StackPtr := pred(StackPtr);
      while VarStack[StackPtr].VarNum <> -1 do
        begin
          with VarStack[StackPtr] do Variables[VarNum] := VarDetails;
          StackPtr := pred(StackPtr)
        end
    end;        ( The FindFact function call the Eval function )

    FUNCTION FindFact(Sptr : integer; s : FactType) : boolean;
    var c : FactType; FindOk : boolean;

      FUNCTION CheckArg(n : integer) : boolean;
      begin
        case c.ArgInfo[n].AType of
        VarPtr  : CheckArg := true;
        NumPtr  : CheckArg := (c.ArgInfo[n].Aval = s.ArgInfo[n].Aval);
        TextPtr : CheckArg := (c.ArgInfo[n].APtr = s.ArgInfo[n].Aptr)
        end
      end;

      PROCEDURE PassValuesBack;
      begin
        for loop := 1 to 3 do with s.ArgInfo[loop] do
          if AType = VarPtr then Variables[APtr] := PassVars[loop]
      end;

      PROCEDURE EvalNewRule;   ( evaluate a new condition list (complicated) )
      var loop : integer;
      begin
        PushVars; ClearVariables;                ( push all known variables )
        condPtr := 0; CPtr := c.RulePtr;
        repeat
          condPtr := succ(condPtr);
          TempArray[condPtr] := Conditions[CPtr];
          CPtr := Conditions[Cptr].RulePtr
        until CPtr = 0;
        for loop := 1 to 3 do with c.ArgInfo[loop] do
          if (AType = VarPtr) and (s.ArgInfo[loop].AType <> VarPtr)
            then Variables[APtr] := s.ArgInfo[loop];
        FindOk := Eval(None,TempArray,1,condPtr);
        for loop := 1 to 3 do with c.ArgInfo[loop] do
          if AType = VarPtr then PassVars[loop] := Variables[Aptr]
          else PassVars[loop] := c.ArgInfo[loop];
        PullVars; PassValuesBack
      end;

    begin ( FindFact function )
      FindOk := false; c := Facts[Sptr];
      if (c.Predicate = s.Predicate) and (c.SentMode = s.SentMode) then
      begin
        for loop := 1 to 3 do PassVars[loop] := c.ArgInfo[loop];

      case s.SentMode of
      PreFix  : FindOk := (((c.ArgInfo[1].Atype = s.ArgInfo[1].Atype) and
                            CheckArg(1)) or (c.ArgInfo[1].AType = VarPtr) or
                            (s.ArgInfo[1].AType=VarPtr)) and
                          (((c.ArgInfo[2].Atype = s.ArgInfo[2].Atype) and
                            CheckArg(2)) or (c.ArgInfo[2].AType = VarPtr) or
                            (s.ArgInfo[2].AType = VarPtr)) and
                          (((c.ArgInfo[3].Atype = s.ArgInfo[3].Atype) and
                            CheckArg(3)) or (c.ArgInfo[3].AType = VarPtr) or
                            (s.ArgInfo[3].AType = VarPtr));
      InFix   : FindOk := (((c.ArgInfo[1].Atype = s.ArgInfo[1].Atype) and
                            CheckArg(1)) or (c.ArgInfo[1].AType = VarPtr) or
                            (s.ArginfoI1].AType = VarPtr))  and
                          (((c.ArgInfo[2].Atype = s.ArgInfo[2].Atype) and
                            CheckArg(2)) or (c.ArgInfo[2].AType = VarPtr) or
                            (s.ArgInfo[2].AType = VarPtr));
      Postfix : FindOk := (((c.ArgInfo[1].AType = s.ArgInfo[1].AType) and
                            CheckArg(1)) or (c.ArgInfo[1].AType = VarPtr) or
                            (s.ArgInfo[1].AType = VarPtr))
      end;                 ( There must be an easier way ! )
      if FindOk then
        begin if c.RulePtr<>0 then EvalNewRule else PassValuesBack end
    end;
    FindFact := FindOk
  end;

  FUNCTION AnyUnknown(CondInfo : FactType) : integer;
  var t,loop : integer;
  begin
    t := 0;             ( More than one unknown causes an error )
    with CondInfo do
      for loop := 1 to ArgNums[SentMode] do
        if ArgInfo[loop].AType = VarPtr then
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        begin
          if t=0 then t:=loop else begin GlobEr:=true; ErNum:=8 end
        end;
    AnyUnknown := t
  end;

  PROCEDURE SetVar(x : integer; v : real);
  begin Variables[x].AType := NumPtr; Variables[x].AVal := v end;

  FUNCTION DoSUM(CondInfo : FactType) . boolean;  { SUM function }
  begin
    if AnyUnknown(CondInfo) = 0 then
      with CondInfo do
        DoSum := (abs(ArgInfo[1].AVal+ArgInfo[2].AVal-ArgInfo[3].AVal) <0.005)
    else
    begin
      with CondInfo do
        case AnyUnknown(CondInfo) of
        1 : SetVar(ArgInfo[1].APtr,ArgInfo[3].AVal-ArgInfo[2].AVal);
        2 : SetVar(ArgInfo[2].Aptr,ArgInfo[3].AVal-ArgInfo[1].AVal);
        3 : SetVar(ArgInfo[3].Aptr,ArgInfo[1].AVal+ArgInfo[2].AVal)
        end;
      DoSum := true
    end
  end;

  FUNCTION DoTIMES(CondInfo : FactType) : boolean;  { TIMES function }
  begin
    if AnyUnknown(CondInfo) = 0 then
      with CondInfo do
      DoTIMES := (abs(ArgInfo[1].AVal*ArgInfo[2].AVal-ArgInfo[3].AVal)<0.005)
    else
    begin
      with CondInfo do
        case AnyUnknown(CondInfo) of
        1 : SetVar(ArgInfo[1].APtr,ArgInfo[3].AVal/ArgInfo[2].AVal);
        2 : SetVar(ArgInfo[2].Aptr,ArgInfo[3].AVal/ArgInfo[1].AVal);
        3 : SetVar(ArgInfo[3].Aptr,ArgInfo[1].AVal*ArgInfo[2].AVal)
        end;
      DoTIMES := true
    end
  end;

  FUNCTION DoINT(CondInfo : FactType) : boolean;  { INT function }
  begin
    with CondInfo do
    case SentMode of
    InFix   : if ArgInfo[2].AType = VarPtr then
              begin
                DoInt := true;
                Variables[ArgInfo[2].APtr].AType := NumPtr;
                Variables[ArgInfo[2].APtr].AVal := int(ArgInfo[1].AVal)
              end;
      PostFix : if AnyUnknown(CondInfo)=1 then begin GlobEr:=true; ErNum:=8 end
                else DoINT := (ArgInfo[1].AVal = int(ArgInfo[1].AVal))
    end
  end;

  FUNCTION DoLESS(CondInfo : FactType) : boolean;  { LESS function }
  begin
    if AnyUnknown(CondInfo)<>0 then begin GlobEr:=true; ErNum:=8 end
    else with CondInfo do
    begin
      if (ArgInfo[1].AType = VarPtr) or (ArgInfo[2].AType = VarPtr) then
        begin GlobEr := true; ErNum := 8 end
      else DoLESS:=(ArgInfo[1].AVal<ArgInfo[2].AVal)
    end
  end;

  FUNCTION DoEQ(CondInfo : FactType) : boolean;    { EQ function }
  begin
    DoEQ := true;
    if AnyUnknown(CondInfo) = 0 then
      with CondInfo do
        DoEQ := (ArgInfo[1].AType = ArgInfo[2].AType) and
                ((ArgInfo[1].AType = NumPtr) and
                 (ArgInfo[1].AVal = ArgInfo[2].AVal)) or
                ((ArgInfo[1].AType = TextPtr) and
                 (ArgInfo[1].APtr = ArgInfo[2].APtr))
    else
     with CondInfo do
       case AnyUnknown(CondInfo) of
       1 : Variables[ArgInfo[1].APtr] := ArgInfo[2];
       2 : Variables[ArgInfo[2].APtr] := ArgInfo[1]
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      end
  end;

  PROCEDURE DoInput(CondInfo : FactType);   { Get value from keyboard }
  var UserIn : strfield; VarNum,er : integer;
  begin
    VarNum := ConvVarToNum(RetArg(CondInfo.ArgInfo[1].APtr));
    with Variables[VarNum] do
    begin
      readln(UserIn);
      if CheckForReal(UserIn) then
        begin AType := NumPtr; val(UserIn,AVal,er) end
      else
        begin AType := TextPtr; APtr := SaveArg(UserIn) end
    end
  end;

  PROCEDURE DoReserved(x : FactType);  { Perform a special function }
  begin
    PredVal := x.Predicate;
    if PredVal = SUMPtr then Fail := not(DoSUM(x));
    if PredVal = TIMESPtr then Fail := not(DoTIMES(x));
    if PredVal = INTPtr then Fail := not(DoINT(x));
    if PredVal = LESSPtr then Fail := not(DoLESS(x));
    if PredVal = EQPtr then Fail := not(DoEQ(x));
    if PredVal = PPtr then DoPrint(RetArg(x.ArgInfo[1].APtr),Screen);
    if PredVal = PPPtr then
      begin DoPrint(RetArg(x.ArgInfo[1].APtr),Screen); writeln end;
    if PredVal = Rptr then DoInput(x);
    if x.Negative then Fail := not(Fail)
  end;

  PROCEDURE EvalWhich(Depth : integer); { Don't ask how this works ! }

  Var OldStack,rptr,Mainloop,ConditionNum,A,ArgVarPtr : integer;
      EvalFound,Update : boolean;  TempStr,TempWhichStr,ClrV : strfield;
      OldCond  : FactType; TempVars : array[1..100] of StackType;
      SwapVars : array[0..63] of integer;

    PROCEDURE ConvertVars;  { change variables into real values }
    begin
      for loop := 1 to 3 do
        with TestCond[Depth].ArgInfo[loop] do
          if (AType = VarPtr) and (Variables[APtr].AType <> Undefed) then
            TestCond[Depth].ArgInfo[loop] := Variables[APtr]
    end;

    FUNCTION CheckKnownArgs(x,y : FactType) : boolean; var loop : integer;
    begin
      CheckKnownArgs := true;
      for loop := 1 to ArgNums[x.SentMode] do with x.ArgInfo[loop] do
       if y.ArgInfo[loop].AType = AType then
       case AType of
       TextPtr : if APtr <> y.ArgInfo[loop].APtr then CheckKnownArgs := false;
       NumPtr  : if AVal <> y.ArgInfo[loop].AVal then CheckKnownArgs := false
       end
    end;

  begin
    if TestCond[Depth].Predicate < LastSpecial then
    begin
      OldCond := TestCond[Depth];
      ConvertVars; Fail := false;      { Evaluate a special predicate }
      DoReserved(TestCond[Depth]);     { E.g. SUM(1 2 x)              }
      if not(Fail) then
      begin
        if Depth = num then
        begin
          DoPrint(WhichStr,Stack); StackVar.VarNum := -1;
          PushStack(StackVar)
        end
        else EvalWhich(succ(Depth))    { If not last Condition do the next }
      end;
      TestCond[Depth] := OldCond
    end
    else
    begin ( Evaluate Normal fact )
      EvalFound := false;
      for Mainloop := 1 to pred(NextFact) do  [ Check all defined facts )
      begin
        Spaces(60,ClrV);

   if Depth = 1 then ClearVariables   { For first Cond clear all Vars }
   else for loop := 0 to 59 do
     if Variables[loop].AType = Undefed then ClrV[succ(loop)] := '*
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      else ClrV[succ(loop)] := ' ';
    Update := false;
    if (Facts[Mainloop].Predicate = TestCond[Depth].Predicate) and
       (Facts[Mainloop].SentMode  = TestCond[Depth].SentMode) and
       CheckKnownArgs(TestCond[Depth],Facts[Mainloop]) then
    begin
    if Facts[Mainloop].RulePtr <> 0 then  { Check a rule type fact }
    begin
      OldCond := TestCond[Depth];  ConvertVars;
      ConditionNum := 1; rptr := Facts[Mainloop].RulePtr;
      while rptr <> 0 do
      begin
        ConditionNum := succ(ConditionNum);
        TempArray[ConditionNum] := Conditions[rptr];
        rptr := Conditions[rptr].RulePtr
      end;
      for loop := 0 to 63 do SwapVars[loop] := -1;
      TempWhichStr := WhichStr; WhichStr := '';
      PushVars; ClearVariables;
      for loop := 1 to ArgNums[Facts[Mainloop].SentMode] do
       with Facts[Mainloop].ArgInfo[loop] do
      begin
        ArgVarPtr := TestCond[Depth].ArgInfo[loop].Aptr;
        case AType of
        VarPtr : begin
                   WhichStr := WhichStr + ConvNumtoVar(APtr) + ' ';
                   if TestCond[Depth].ArgInfo[loop].AType = VarPtr then
                    SwapVars[APtr] := ArgVarPtr
                   else
                    Variables[APtr] := TestCond[Depth].ArgInfo[loop]
                 end;
        TextPtr: begin
                   Str(APtr,TempStr);
                   WhichStr := WhichStr+chr(255)+chr(60+loop)+
                               TempStr+' ';
                   SwapVars[60+loop] := ArgVarPtr
                 end;
        NumPtr : begin
                   Str(AVal,TempStr);
                   WhichStr := WhichStr+chr(254)+chr(60+loop)+
                               TempStr+' ';
                   SwapVars[60+loop] := ArgVarPtr
                 end
        end
      end;

      OldStack := StackPtr;
      EvalFound := Eval(Which,TempArray,2,ConditionNum);
      for loop := 0 to pred(StackPtr - OldStack) do
       TempVars[succ(loop)] := VarStack[OldStack+loop];
      WhichStr := TempWhichStr; StackPtr := OldStack;
      PullVars; OldStack := 1;
      while TempVars[OldStack].VarNum <> -2 do
      begin
        EvalFound := false;
        while TempVars[OldStack].VarNum <> -1 do
          with TempVars[OldStack] do
          begin
            Variables[SwapVars[VarNum]] := VarDetails;
            OldStack := succ(OldStack); EvalFound := true;
          end;
        OldStack := succ(OldStack);  { Skip -1 }
        if EvalFound then
              begin
                if Depth = num then
                  begin
                    DoPrint(WhichStr,Stack);
                    StackVar.VarNum:=-1; PushStack(StackVar)
                  end
                else EvalWhich(succ(Depth))
              end
            end;
            TestCond[Depth] := OldCond
          end
          else   { Evaluate a fact without conditions }
          begin
            OldCond := TestCond[Depth]; ConvertVars;  { Remember initial fact }
            if FindFact(Mainloop,TestCond[Depth]) then
            begin
              if TestCond[Depth].Negative then EvalFound := true
              else
              begin
                if Depth = num then
                  begin DoPrint(WhichStr,Stack); Update := true end
                else EvalWhich(succ(Depth))
              end
            end;
            TestCond[Depth] := OldCond;  { Restore fact with variables }
            if (Depth = num) and Update then
            begin
              StackVar.VarNum := -1; PushStack(StackVar)
            end
          end
        end;
        if Depth <> 1 then
          for loop := 0 to 59 do if ClrV[succ(loop)] = '*' then
            Variables[loop].AType := Undefed
      end; { End of FOR loop }
      if TestCond[Depth].Negative then
      begin
        if not(EvalFound) then
          if Depth = num then
          begin
            DoPrint(WhichStr,Stack);
            StackVar.VarNum := -1; PushStack(StackVar)
          end
          else EvalWhich(succ(Depth))
      end
    end;
    if Depth = StartCond then
      begin StackVar.VarNum := -2; PushStack(StackVar) end
  end;  { End of EvalWhich }

begin   { Start of Eval }
  if EvalType <> Which then
  begin
    count := 1; Fail := false;
    repeat
      if (TestCond[count].Predicate <> RPtr) and
         (TestCond[count].Predicate <> PPtr) and
         (TestCond[count].Predicate <> PPPtr) then
        for loop := 1 to 3 do
          with TestCond[count].ArgInfo[loop] do
            if (AType = VarPtr) and (Variables[APtr].AType <> Undefed) then
                TestCond[count].ArgInfo[loop] := Variables[APtr];

      if TestCond[count].Predicate < LastSpecial then
        DoReserved(TestCond[count])
      else
      begin
        Sloop := 1; FFound := false;
        repeat
          FFound := FindFact(Sloop,TestCond[count]);
          Sloop := succ(Sloop)
        until (Sloop = NextFact) or FFound or GlobEr;
        if TestCond[count].Negative then FFound := not(FFound);
        if FFound = false then Fail := true
      end;
      count := succ(count)
    until (count > num) or Fail or GlobEr
  end
  else EvalWhich(StartCond);
  Eval := not(Fail)
end;  { End of Eval }

PROCEDURE GetConditions; var ExtraPtr,c : integer; CondStr,temp : LongStr;
begin
  CondStr := ComStr; c := 0; GlobEr := false;
  repeat
    ComStr := OverSpaces(CondStr);
    if c>0 then temp := GetWord;   { skip IF or & }
    ExtraPtr := pos('&',ComStr);   { move all conditions into test array }
    if ExtraPtr <> 0 then
    begin
      CondStr := copy(ComStr,ExtraPtr,255);
      ComStr := copy(ComStr,1,pred(ExtraPtr))
    end;
    GetParams(OverSpaces(ComStr));
    If ExtraPtr <> 0 then NewSent.RulePtr := succ(NextCond);
    c := succ(c); Conds[c] := NewSent;
  until ExtraPtr = 0;
  NumOfConds := c
end;

PROCEDURE DoIS;  var Result : boolean;  { This IS function }
begin
```

```
    ClearVariables; skip(3);                { skip IS(  )
    GetConditions;  StackPtr := 1;          { Initialise Variable Stack Pointer }
    Result := Eval(Is,Conds,1,NumOfConds);{ Do it }
    if not(GlobEr) then
      begin if Result then writeln('YES') else writeln('NO'); writeln end
  end;

  PROCEDURE DoWhich;  var p : integer; Result,FoundVar : boolean;
  begin
    ClearVariables; skip(6);    { skip over WHICH( )
    p := pos(':',ComStr);
    if p = 0 then ErNum := 1
    else
    begin
      WhichStr := copy(ComStr,1,pred(p)); ComStr := copy(ComStr,succ(p),255);
      GetConditions; StackPtr := 1; Result := Eval(Which,Conds,1,NumOfConds);
      if Not(GlobEr) then
      begin
        StackPtr := 1;
        while VarStack[StackPtr].VarNum <> -2 do
        begin
          FoundVar := false;
          while VarStack[StackPtr].VarNum <> -1 do
            with VarStack[StackPtr] do
            begin
              Variables[VarNum] := VarDetails; StackPtr := succ(StackPtr);
              FoundVar := true;
            end;
          StackPtr := succ(StackPtr);  { Skip -1 }
          if Foundvar then begin DoPrint(WhichStr,Screen); writeln end
        end;
        writeln('No (more) answers'); writeln
      end
    end
  end;

  PROCEDURE DelPred(c : integer);
  begin
    if c<>pred(NextFact) then
      for loop:=c to pred(NextFact) do Facts[loop]:=Facts[succ(loop)];
    NextFact := pred(NextFact)
  end;

  PROCEDURE Delete;
  var PredName : LongStr; c,PredNum,n,ner : integer;
  begin
    Change := true; skip(7); PredName := GetUpToChar(' ');
    if ComStr = '' then ErNum := 1
    else
    begin
      ComStr := StripSpace(ComStr); val(ComStr,n,ner);
      if ner <> 0 then ErNum := 1
      else
      begin
        PredNum := GetPredNum(PredName);
        if PredNum = 0 then ErNum := 4
        else
        begin
          c := 1;
          repeat
            if Facts[c].Predicate = PredNum then n := pred(n);
            if n <> 0 then c := succ(c)
          until (n = 0) or (c = NextFact);
          if n <> 0 then ErNum := 5 else DelPred(c)
        end
      end
    end
  end;

  PROCEDURE Kill;
  var PredNum,p : integer;
  begin
    skip(5);
    if ComStr = '' then ErNum := 1
    else
    begin
      if ToUpper(ComStr) = 'ALL' then
      begin
        if GetYesOrNo('Kill All Facts') then
        begin
          PredPtr := LastSpecial; ArgPtr := 1; NextFact := 1; NextCond := 1;
          Change := false
        end
      end
      else
      begin
        PredNum := GetPredNum(ComStr);
        if PredNum = 0 then ErNum := 4
        else
          if GetYesOrNo('Kill '+ComStr) then
          begin
            Change := true;
            for p := 1 to pred(NextFact) do
              if Facts[p].Predicate = PredNum then
                begin DelPred(p); p := pred(p) end

          end
      end; writeln
    end
  end;

  PROCEDURE SaveData; { saves current data. E.g. SAVE PAYROLL }
  begin
    skip(5);
    if ComStr = '' then ErNum := 1
    else
    begin
      write('Saving ',ComStr);  CurFileName := ToUpper(ComStr);
      Assign(NumFile,ComStr+'.txt');
      rewrite(NumFile);
      writeln(NumFile,PredPtr);     writeln(NumFile,ArgPtr);
      writeln(NumFile,NextFact);    writeln(NumFile,NextCond);
      writeln(NumFile,LastSpecial); close(NumFile);
      if NextFact > 1 then
      begin
        assign(SentFile,ComStr+'.snt'); rewrite(SentFile); seek(SentFile,0);
        for loop := 1 to pred(NextFact) do write(SentFile,Facts[loop]);
        close(SentFile);
        assign(SentFile,ComStr+'.cnd'); rewrite(SentFile); seek(SentFile,0);
        for loop := 1 to pred(NextCond) do write(SentFile,Conditions[loop]);
        close(SentFile);
        assign(CharFile,ComStr+'.arg'); rewrite(CharFile); seek(CharFile,0);
        for loop := 1 to pred(ArgPtr) do
          begin CharRec.Cdef := Args[loop]; write(CharFile,CharRec) end;
        close(CharFile);
        assign(CharFile,ComStr+'.prd'); rewrite(CharFile); seek(CharFile,0);
        for loop := 1 to pred(PredPtr) do
          begin CharRec.Cdef := Preds[loop]; write(CharFile,CharRec) end;
        close(CharFile)
      end;
      writeln; writeln; Change := false  { Reset change flag }
    end
  end;

  PROCEDURE LoadData;    { Load a set of Facts from disk. E.g. LOAD PAYROLL }
  begin
    if Change then Change := GetYesOrNo('Current Data NOT Saved - Abort');
    if not(Change) then
    begin
      skip(5);
      if ComStr = '' then ErNum := 1
      else
      begin
        Assign(NumFile,ComStr+'.txt'); CurFileName := ToUpper(ComStr);
        {$I-} reset(NumFile) {$I+};
        if IOresult <> 0 then begin ErNum := 6; CurFileName :=     end
        else
        begin
          write('Loading ',ComStr);
          readln(NumFile,PredPtr);      readln(NumFile,ArgPtr);
          readln(NumFile,NextFact);     readln(NumFile,NextCond);
          readln(NumFile,LastSpecial);  close(NumFile);
          if NextFact > 1 then
          begin
            assign(SentFile,ComStr+'.snt'); reset(SentFile); seek(SentFile,0);
            for loop := 1 to pred(NextFact) do read(SentFile,Facts[loop]);
            close(SentFile);
            assign(SentFile,ComStr+'.cnd'); reset(SentFile); seek(SentFile,0);
            for loop := 1 to pred(NextCond) do read(SentFile,Conditions[loop]);
            close(SentFile);
            assign(CharFile,ComStr+'.arg'); reset(CharFile); seek(CharFile,0);
            for loop := 1 to pred(ArgPtr) do
              begin read(CharFile,CharRec); Args[loop] := CharRec.Cdef end;
            close(CharFile);
            assign(CharFile,ComStr+'.prd'); reset(CharFile); seek(CharFile,0);
            for loop := 1 to pred(PredPtr) do
              begin read(CharFile,CharRec); Preds[loop] := CharRec.Cdef end;
            close(CharFile)
```

```
        end;
      writeln; writeln; Change := false  { Reset Change made flag }
      end
    end
  end;

PROCEDURE DoStatus;
begin
  writeln('CURRENT DATABASE STATUS'); writeln;
  if CurFileName <> '' then writeln('Current Data File Name ..  ',CurFileName);
  writeln('Number of Facts ..... ',pred(NextFact));
  writeln('Number of Conditions .... ',pred(NextCond));
  writeln('Predicate Space Used .... ',pred(PredPtr),' bytes');
  writeln('Argument Space Used ..... ',pred(ArgPtr),' bytes');
  writeln('Changes Made ..... ',Change); writeln
end;

PROCEDURE DoExit;
begin
  if not(Change) then ProgExit := true
  else ProgExit := GetYesOrNo('Changes Made ! Finish')
end;

PROCEDURE ProcessFact;
var PredPart : strfield; PredNum : integer; conds : Condarray; ok : boolean;

  FUNCTION GetChars(n : integer) : strfield;
  begin GetChars := ToUpper(copy(ComStr,1,n)) end;

begin              { these are the main commands the program knows }
  ErNum := 0;
  if GetChars(3) = 'BYE' then DoExit else
   if GetChars(3) = 'ADD' then DoAdd else
    if GetChars(4) = 'LIST' then List else
     if GetChars(6) = 'DELETE' then Delete else
      if GetChars(4) = 'KILL' then Kill else
       if GetChars(4) = 'SAVE' then SaveData else
        if GetChars(4) = 'LOAD' then LoadData else

         if GetChars(2) = 'IS' then DoIS else
          if GetChars(5) = 'WHICH' then DoWhich else
           if GetChars(4) = 'STAT' then DoStatus else
          begin
            PredPart := GetWord; PredNum := GetPredNum(PredPart+' ');
            if PredNum = 0 then ErNum := 2
            else
            begin
              conds[1].Predicate := PredNum;
              conds[1].SentMode := PostFix;
              if CheckForVar(ComStr) then ErNum := 1
              else
              with conds[1].ArgInfo[1] do
              begin
                if CheckForReal(ComStr) then
                  begin AType := NumPtr; AVal := ConvToReal(ComStr) end
                else
                  begin AType := TextPtr; APtr  := SaveArg(ComStr) end;
                conds[1].ArgInfo[2].AType := Undefed;
                conds[1].ArgInfo[3].AType := Undefed;
                ClearVariables; ok := Eval(Is,conds,1,1)

              end
            end
          end;
  if ErNum <> 0 then begin writeln(ER[ErNum]); writeln end
end;

begin                { MAIN SECTION OF CODE }
  ProgExit := false;
  InitData;                                  { Set up all pointers }
  repeat
    repeat
      ComStr := ReadFromTerm;                { Get Input from Keyboard     }
      if BrackOn <> 0 then writeln(ER[1])    { Too many closing brackets ! }
    until BrackOn = 0;
    writeln;
    GlobEr := false; ErNum := 0;
    ProcessFact                              { Process User's Input }
  until ProgExit
end.
```

Amstrad PCW8256 AUTO.COM

by CP Vickerstaff

This short utility program prompts for a disk to be inserted. It then makes a directory of all the Basic programs on the disk, and lists them onscreen eight at a time with the option of running any of those listed. It can be set up to boot automatically from switch-on.

To do this, make a working disk with CP/M, BASIC, DIR, ERASE, SUBMIT, PIP and any other utilities you regularly use. Run BASIC and enter the program listed; save this as AUTO.COM. Next, copy RPED.BAS to your working disk and run it under Basic. Select the new file option and enter PROFILE.SUB as the filename; type in the second program as shown. Exit RPED and you are ready to go. Remove the disk, reset the computer and try it out. You can then copy any Basic programs to this disk, and when you boot the disk, a couple of key presses will get any of these programs up and running.

```
PROGRAM 1      AUTO.COM
10 RESET:OPTION FILES "A":CLEAR:DIM a$(64)
20 esc$=CHR$(27):cls$=esc$+"E"+esc$+"H":ron$=esc$+"p":rof$=esc$+"q"
30 DEF FNlocate$(y,x)=esc$+"Y"+CHR$(x+32)+CHR$(y+32)
40 DEF FNsc$(title$)=STRING$((88-LEN(title$))/2,"-")+" "+title$+" "+STRING$((87-
LEN(title$))/2,"-")+CHR$(10)+CHR$(13)
50 PRINT esc$;"f";cls$;FNsc$("BASIC AUTO LOAD");
60 PRINT FNlocate$(0,2);FNsc$("Insert program disc")
70 PRINT FNlocate$(0,4);FNsc$("and press space")
80 GOSUB 270
90 PRINT FNlocate$(0,2);STRING$(90,"-");
100 PRINT FNlocate$(0,4);SPACE$(90);
110 FOR i=1 TO 64:a$=FIND$("*.BAS",i):IF a$<>"" THEN a$(i)=a$:a=a+1 ELSE i=65
120 NEXT:IF a=0 THEN RUN
130 FOR i=1 TO 64 STEP 8:x=1
140 FOR k=0 TO 10:PRINT FNlocate$(35,k+7);ron$;SPACE$(21);rof$:NEXT
150 PRINT FNlocate$(36,7);ron$;esc$;"r       ";esc$;"u";rof$
160 PRINT FNlocate$(36,8);" PRESS "
170 z=1:FOR j=0 TO 7:y=j:z=z+1
180 IF i+j>a THEN j=8:i=64:GOTO 200
190 PRINT FNlocate$(36,9+j);j+1;ron$;" ===== ";LEFT$(a$(i+j),INSTR(a$(i+j),".")
-1);rof$
200 NEXT
210 IF x+y<a THEN PRINT FNlocate$(0,27);FNsc$("Press RETURN to continue list");
220 GOSUB 270
230 IF y+x-1<=a AND v>0 AND v<z THEN PRINT cls$;esc$"eLoading ";a$(x+v-1):RUN a$
(x+v-1)
240 IF a$<>CHR$(13) THEN 220
250 NEXT
260 RUN
270 WHILE a$<>"":a$=INKEY$:WEND
280 a$="":WHILE a$="":a$=INKEY$:WEND
290 v=VAL(a$):RETURN

PROGRAM 2      PROFILE.SUB
basic.com auto.com
^Z
```

Commodore 64 Tape Counter Calculator

by AP Sutton

MICROTEX 666

This program is available electronically through Microtex 666's software downloading service. It is accessed through Viatel page *66637#.

This program calculates the relationship between time elapsed from the start of a tape and the counter reading for most types of tape recorders, including video. Instructions for using the program are included within it. Printer output for tables is set to channel four.

The heart of the program is the solution of the simultaneous equations based on time elapsed and counter reading. The generalised form is:

TIME=alpha * K*K+beta * K+gamma

where K is the counter reading.

The routines used are as follows:

Lines 8000-8090: open storage/retrieval files

Lines 8100-8150: reads the error channel and flags if a file exists, and so on.

Line 2130: a keyboard input routine.

Lines 2820-2868: get data from a file.

Lines 9600-9710: hold machine code data to install an ON ERROR routine. It's called by SYS 49264, line-to-go-to. SYS 49315 turns it off.

Lines 500-590: handle any errors that do occur.

Lines 2300-2390: main routine.

```
10 GOSUB1000:GOSUB800
20 GOTO2600
500 REM ERROR TRAP DESTINATION  ER=ERROR (128=BREAK),LN=LINE NO.
510 IF DV<>1 THEN CLOSE2
515 CLOSE4:CLOSE15:SYS65511:REM ABORT ALL FILES
520 IF ER=128 OR ER=30 THEN 2600
525 GOSUB1050:PRINT"AN ERROR HAS OCCURRED ";
527 IF ER<>5 THEN 600
530 EM$(5)="DISK DRIVE"
540 IF DV=4 THEN EM$(5)="PRINTER"
550 EM$(5)=EM$(5)+" NOT CONNECTED"
560 EM=5:GOSUB1700:GOSUB1450
590 GOTO 2600
600 REM
660 PRINT"AT LINE":LN
670 SYS 49315:REM RESTORE NORMAL VECTORS
680 POKE 781,ER:SYS42042 :REM PRINT ERROR DESCRIPION
690 END
800 REM ERROR TRAP MACHINE CODE DATA (NON ESSENTIAL ROUTINE)
805 PRINT"WRITING MACHINE CODE ....."
810 AD=49154:AF=AD+178:E=-1
820 LN=9590:LM=10:HL=9710
850 DEFFNN(N)=(CH+N+N*(XAND1))AND255
860 LN=LN+LM
870 X=0:CH=0:N=LN:CH=FNN(N)
880 FORX=1TO16
890 READN:CH=FNN(N):IF E THENPOKEAD,N
900 AD=AD+1:IFAD>AFTHENE=0
910 NEXT:PRINT"AT LINE";LN
920 READN:IF(N=CH)AND(AD<=AF)THEN860
930 IF(AD>AF)AND(LN=HL)THENPRINT"OK":GOTO970
940 IF(AD>AF)THENPRINT"TOO FEW LINES":END
950 PRINT"CHECKSUM ERROR IN LINE";
960 PRINT256*(PEEK(64))+PEEK(63):STOP
970 SYS49264,500:REM SET UP ERROR TRAP, DESTINATION=LINE 500
980 RETURN
999 END
1000 REM SET-UP
1010 DIM K(2),T(2),DK(2),DT(2),EM$(17)
1030 DEF FNT(K)=AL*K*K+BE*K
1040 D1=0:KE$=" ":NF=0:CT=-1:DG=4
1050 CR$=CHR$(13)
1060 DV$="D":DISK=8:DV=DI:RW$=",S,W":FI$=",TAPES.":MAX=50
1070 DIMMU$(9),NA$(MAX),A(MAX),B(MAX),D(MAX),L(MAX)
1072 FORX=0TO9:READMU$(X):NEXT
1074 FORX=0TO17:READEM$(X):NEXT
1099 RETURN
1100 REM A TO A$,LENGTH A1,DECIMAL D1
1105 FZ$="000000000":IF A1<0THENFZ$="          ":A1=ABS(A1)
1110 AZ=INT(A):AY=INT((A-AZ)*10 D1+.5)
1115 IF D1=0 THEN AZ=INT(A+.5)
1120 AZ$=MID$(STR$(AZ),2):AY$=MID$(STR$(AY),2)
1130 IF D1<>0 THEN AZ$=AZ$+"."+AY$
1140 A$=RIGHT$(FZ$+AZ$,A1)
1150 RETURN
1160 REM CLEAR BUFFER
1170 GET A$:IFA$<>""THEN1170
1180 RETURN
1200 REM TIME TO COUNTER AS STRING
1210 GOSUB1600:A=K
1220 IF A>=DN THEN A=A-DN :GOTO 1220
1230 IF A<-.5 THEN A=A+DN
1240 D1=0:A1=DG:GOSUB1100:A$=RIGHT$("       "+A$,6)
1250 RETURN
1300 REM  PRINT LINE Y DOWN,Z ACROSS
1310 A1=-2:A=Y/10:D1=0:GOSUB1100
1320 PRINT#4,A$;"X ";
1330 FORZ=0TO9
1340 T=(Y+Z)*60:GOSUB1200
1350 PRINT#4,A$;
1360 NEXT Z:PRINT#4," ";
1370 T=(Y+10)*60:GOSUB1660:K1=K:T=T-600:GOSUB1660:T1=ABS(K1-K)/600
1380 FOR2=1TO3
1390 A=T1*Z*15:A1=-4:D1=0:GOSUB1100
1400 PRINT#4,A$;
1410 NEXT Z
1420 PRINT#4," "
1430 RETURN
1450 REM WAIT
1455 RR=23:CC=5:GOSUB1800:PRINT"( PRESS SPACE TO CONTINUE )"
1460 GETA$:IFA$="" THEN 1460
1470 GOSUB1550
1480 IFEX=-1 THEN 1460
1485 GOSUB1160
1490 RETURN
1500 REM NOMINAL LENGTH
1510 T$="ENTER NOMINAL LENGTH (5-240MINS)":T1$="  "
1515 GOSUB2100
1520 NL=INT(VAL(N$))
1530 IF NL<5 OR NL>240 THEN EM=1:GOSUB1700:GOTO 1510
1540 RETURN
1550 REM SCAN KEY
1555 EX=-1
1560 FOR XX=1TOLEN(KE$)
1570 IFA$=MID$(KE$,XX,1)THENEX=XX:XX=99
1580 NEXT
1590 RETURN
1600 REM FORM TABLE
1610 FOR Y=0 TO NL STEP 10
1620 IF (Y/60)=INT(Y/60) THEN PRINT#4," "
1630 GOSUB1300
1640 NEXT Y
1650 RETURN
1660 REM TIME T (SECS) TO COUNTER K
1665 IF AL=0 THEN K=T/BE:RETURN
1670 IF AL>0 THEN 1685
1675 IF (BE*BE+4*AL*T)<0THEN ER=1:RETURN
1685 K=(SQR(BE*BE+4*AL*T)-BE)/2/AL
1690 RETURN
1700 REM ERROR PRINT
1710 RR=22:CC=0:GOSUB1800:PRINTEM$(0);
1720 RR=22:CC=19-LEN(EM$(EM))/2:GOSUB1800:PRINTEM$(EM);
1740 RETURN
1750 REM CLEAR MESSAGES
1760 CC=0:FOR RR=20 TO 23:GOSUB1800
1770 PRINTEM$(0);
1780 NEXT
1790 RETURN
1800 REM PRINT AT CCOL,RROW ROUTINE
1810 POKE782,CC:POKE781,RR:POKE783,48:SYS65520:RETURN
1850 REM SCREEN CLEAR
1860 PRINT CHR$(147);:RETURN
1900 REM DEVICE
1920 T$="TAPE OR DISK ?":T1$=DV$+"                "
1930 GOSUB2100
```

```
1933 N$=LEFT$(N$,1)
1935 IFN$="D"THENDV$="D":DV=8:RETURN
1940 IFN$="T"THENDV$="T":DV=1:RETURN
1945 GOTO 1920
1950 REM TITLE
1952 GOSUB1850:PRINT:PRINT"          ";MU$(N)
1954 L1$="                            ":REM 27X C= & Y
1956 PRINT"          ";LEFT$(LI$,LEN(MU$(N)))
1958 PRINT
1960 RETURN
2000 REM OBTAIN COUNTER INPUT
2005 N=3:GOSUB1950
2007 PRINTTAB(19-LEN(NA$(PO))/2);NA$(PO)
2009 PRINT" LENGTH ";NL:"MINS";TAB(27);DG;"DIGITS"
2010 FOR X=0 TO 2
2012 GOSUB1750
2020 T$="COUNTER READING"+STR$(X+1)+" - ":T1$=" ":GOSUB2100
2025 K(X)=VAL(N$)
2030 IF K(X)<0 OR K(X)> DN-1 THEN EM=1:GOSUB1700:GOTO 2020
2035 RR=7+4*X:CC=5:GOSUB1800:PRINT T$;N$
2040 GOSUB1750
2050 T$=" TIME (HH.MM.SS) - ":GOSUB2100:GOSUB2200:T(X)=N
2060 IF ER<>0 THEN EM=2:GOSUBI700:GOTO 2050
2065 RR=8+4*X:CC=5:GOSUB1800:PRINTT$;N$
2070 NEXT X
2080 GOSUB1750:RETURN
2100 REM INPUT ROUTINE
2110 RR=21:CC=2:GOSUB1B00:PRINTT$;" ";T1$
2120 CC=LEN(T$)+3:GOSUB1800
2130 OPEN1,0:INPUT#1,N$:CLOSE1:PRINT
2140 IFN$=""THENN$=" "
2150 RETURN
2200 REM DECODE HH.MM.SS
2210 ER=0:IF LEN(N$)><8 THEN ER=1:RETURN
2220 NS$=RIGHT$(N$,2): IF NS$<"00" OR NS$>"59" THEN ER=1:RETURN
2230 NM$=MID$(N$,4,2): IF NM$<"00" OR NM$>"59" THEN ER=1:RETURN
2240 NH$=MID$(N$,1,2): IF NH$<"00" OR NH$>"23" THEN ER=1:RETURN
2250 N=VAL(NS$)+60*VAL(NM$)+3600*VAL(NH$)
2260 RETURN
2300 REM COMPUTE FACTORS
2310 ER=0:FORX=0TO2
2320 DK(X)=K(X)-K((X+1)+3*(X=2))
2330 DT(X)=T(X)-T((X+1)+3*(X=2))
2335 IF DK(X)=0 OR DT(X)=0 THEN ER=1
2340 NEXT
2345 IF ER<>0 THEN RETURN
2350 AL=(DK(0)*DT(1)-DK(1)*DT(0))/(DK(0)*DK(1)*DK(2))
2360 BE=DT(0)/DK(0)-AL*(K(0)+K(1))
2370 IF (AL=0)AND(BE=0) THEN ER=1
2390 RETURN
2400 REM COUNTER DIGITS
2405 RR=21:CC=2:GOSUB1800
2410 T$="NUMBER OF COUNTER DIGITS (2-5) ":T1$=CHR$(4B+DG)+"  "
2415 GOSUB2100
2420 DG=INT(VAL(N$)):IFDG<2 OR DG>5 THENEM=1:GOSUB1700:GOTO 2405
2430 DN=10 DG : REM    POWER
2440 RETURN
2450 REH MAKE CURRENT TAPE
2455 EM=8:GOSUB1700:KE$="YN":GOSUB1460:KE$=" "
2460 IFEX=1THEN CT=PO
2465 1FCT=-1THENRETURN
2470 DG=D(CT):CN$=NA$(CT):AL=A(CT):BE=B(CT):NL=L(CT):DN=10 DG
2480 RETURN
2500 REH TITLE PRINT
2520 T$="COUNTER/TIME TABLE  FOR "+CN$
2530 PRINT#4,SPC(40-LEN(T$)/2);T$
2540 T$="ADD"
2550 IF BE<0 THEN T$="SUBT"
2560 PRINT#4,SPC(67);"FOR SECS ";T$
2570 PRINT#4,"MINS   0   1   2   3   4   5   6   7   8";
2580 PRINT#4,"   9   15  30  45"
2599 RETURN
2600 REM MAIN MENU
2610 GOSUB1850:RR=3:CC=5:GOSUB1B00
2620 PRINT"TAPE COUNTER / TIME CALCULATOR"
2630 RR=RR+I:GOSUB1800
2635 PRINT"                                    ":REM 30 X C= & Y
2640 PRINT:PRINT
2650 FORX=0TO9:PRINT"          ";MU$(X):NEXT
2660 GOSUB1160
2705 N=FRE(0):T1$="9"
2710 T$="ENTER CHOICE (0-9)":GOSUB2100
2720 N=INT(VAL(N$))
2750 IF N$<"0" OR N$>"9" OR LEN(N$)<>1 THEN T1$=N$+"       ":GOTO2710
2760 ON(N+1)GOSUB2780,2900,3000,3100,3400,3600,3700,4100,4200,4500 .
2770 GOTO2600
2780 GOSUB1850
2781 SYS49315:REM DELETE ERROR TRAP
2782 END
2800 REM FILE NAME
2805 FI$=LEFT$(FI$+"              ",12)
2B10 RR=10:CC=8:GOSUB1800
2B20 T$="  FILE NAME  ? ":T1$=FI$+"                    "
2B30 GOSUB2100
2833 FI$=LEFT$(N$+"              ",12)
2850 RETURN
2B60 REM GET FROH DEVICE
2862 N$=""
2B64 GET#2,A$:IFA$=CHR$(I3)THENRETURN
2866 N$=N$+A$:IF ST=0 THEN 2864
2B68 RETURN
2B70 REM LOAD ERROR
2875 EM=14
2B80 GOSUB1700:GOSUB1450:GOSUB8200
2890 RETURN
2900 REM LOAD
2910 N=1:GOSUB1950:GOSUB1900:PO=0
2915 P1=PO:GOSUB3200:IFER<>0THENER=0:RETURN
2920 RW$=",S,R":GOSUB2800
2930 SE=0:GOSUB8000:IFER=-1THEN29B5
2932 EM=5:GOSUB1750
2934 P1=PO:GOSUB3200:IFER<>0THENER=0:GOTO 2985
2935 EM$(5)="LOADING NO."+STR$(NF):GOSUB1700
2936 GOSUB2860:NA$(PO)=N$:IF ST<>0 THEN2870
2938 GOSUB2860:A(PO)=VAL(N$):IF ST<>0 THEN2B70
2940 GOSUB2860:B(PO)=VAL(N$):IF ST<>0 THEN2B70
2942 GET#2,A$:L(PO)=ASC(A$+CHR$(0)):1F ST<>0 THEN 2870
2944 GET#2,A$:D(PO)=ASC(A$+CHR$(0)):IF ST<>0 THEN 2B70
2946 GET#2,A$:IF ASC(A$)<>13 THEN D(PO)=0:GOTO 2870
2948 NF=NF+1
2950 IF ST=0 THEN 2934
2985 GOSUB8200
2990 RETURN
3000 REM SAVE
3010 N=2:GOSUB1950
3015 IF NF=0 THEN EM=9:GOSUB1700:GOTO 1450
3020 GOSUB1900
3030 RW$=",S,W":GOSUB2800
3035 SE=1:REM SECONDARY ADDRESS
3040 GOSUB8000:IFER=-1 THEN 30B5
3045 EM=17:GOSUB1750:GOSUB1700
3050 FORXX=0 TO MAX
3055 IF D(XX)=0THEN3070
3060 PRINT#2,NA$(XX);CR$;A(XX);CR$;B(XX);CR$;CHR$(L(XX));CHR$(D(XX))
3070 NEXT XX
3085 GOSUB8200
3090 RETURN
3100 REM NEW TAPE
3110 N=3:GOSUB1950:P1=0:GOSUB3200:IFER<>0THENER=0:RETURN
3115 RR=10:CC=10:GOSUB1800
3120 PRINT"ENTER TAPE NAME (TITLE) - "+CHR$(13)+CHR$(13)+"  ":GOSUB2130
3130 NA$(PO)=LEFT$(N$,30)
3140 N=3:GOSUB1950
3150 GOSUBI500:L(PO)=NL
3160 N=3:GOSUB1950
3165 GOSUB2400
3170 GOSUB2000:GOSUB2300
3175 IF ER=0 THEN 3190
3180 EM=3:GOSUB1700:KE$="YN":GOSUB1460:KE$=" "
31B4 IFEX=1THEN3170
3186 D(PO)=0:RETURN
3190 A(PO)=AL:B(PO)=BE:NF=NF+1:D(PO)=DG:GOSUB2450
3199 RETURN
3200 REM FIND SPARE PLACE IN FILE
3210 ER=0:IFNF>MAXTHENEM=4:GOSUB1700:GOSUB1450:ER=1:RETURN
3220 FORXX=P1TOMAX
3230 IFD(XX)=0THENPO=XX:XX=MAX+10:ER=0
3240 NEXT
3245 RETURN
3250 REM LIST 10 TYPES
3255 TD=0:P1=PO:FOR XX=0 TO 9
3260 IF P1>MAX THEN XX=10:GOTO 3280
3265 IF D(P1)=0THEN P1=P1+1:GOTO 3260
3270 LT(XX)=P1:PRINTXX"- "NA$(P1);TAB(27);D(P1)TAB(31);
3272 A=L(P1):A1=3:D1=0:GOSUB1100:PRINT"  ";A$
3275 TD=TD+1:P1=P1+1
3280 NEXT
3290 RETURN
```

```
3300 REM SELECT FROM LIST
3310 KE$=LEFT$(" 0123456789",TD+1)
3320 EM=7:GOSUB1700:GOSUB1450
3330 KE$=" "
3340 RETURN
3400 REM CHOOSE CURRENT TYPE
3410 P1=-1:TD=11
3415 IF TD<10 THEN RETURN
3420 PO=P1+1:N=4:GOSUB3500
3430 IF NF=0 THENEM=6:GOSUB1700:GOSUB1450:RETURN
3435 GOSUB3250
3440 IF TD=0 THEN RETURN
3445 GOSUB3300
3450 IF EX=1THEN 3415
3460 CT=LT(EX-2)
3470 EM$(5)="TYPE"+STR$(EX-2)+" SELECTED":EM=5:GOSUB1700:GOSUB1450
3490 RETURN
3500 REM  SELECT TITLE
3510 GOSUB1950
3520 PRINT"   ---TAPE NAME---       DIGITS  LENGTH"
3530 PRINT" NO                              (MINS)"
3540 RETURN
3600 REM DELETE
3610 P1=-1:TD=11
3615 PO=P1+1:IF TD<10 THEN RETURN
3620 N=5:GOSUB3500
3630 IF NF=0 THENEM=6:GOSUB1700:GOSUB1450:RETURN
3635 GOSUB3250
3640 IF TD=0 THEN RETURN
3645 GOSUB3300
3650 IF EX=1THEN 3615
3660 EY=EX:EM$(5)="CONFIRM DELETE TYPE NO"+STR$(EY-2)+" (Y/N)"
3665 EM=5:GOSUB1700:KE$="YN ":GOSUB1460
3670 ON EX GOTO 3675,3620,3615
3675 D(LT(EY-2))=0:NF=NF-1:GOTO 3620
3700 REM PRINT TAPE
3710 N=6:GOSUB1950
3720 IF CT=-1 THENEM=11:GOSUB1700:GOSUB1450:RETURN
3730 IF D(CT)=0 THEN3720
3735 GOSUB2470:GOSUB1750
3740 EM=12:GOSUB1700:GOSUB1450
3750 DW=4:OPEN4,DW,7:REM PRINT CHANNEL
3752 GOSUB1750:EM=13:GOSUB1700
3755 PRINT#4:GOSUB2500:GOSUB1600
3760 PRINT#4:CLOSE4:DW=DV
3790 RETURN
3800 REM SHOW CURRENT TYPE
3810 PRINT" TAPE NAME :- ":CN$
3820 PRINT" NOMINAL LENGTH :- ";NL;" MINS"
3830 PRINT" NO. OF COUNTER DIGITS :- ":DG
3840 RETURN
3900 REM SECS SE  TO HH.MM.SS NF$
3910 SE=INT(SE+.5):NH=INT(SE/3600)
3915 IF NH>23THENNH=NH-24:SE=SE-24*3600:GOTO3915
3920 NM=INT((SE-3600*NH)/60)
3930 NS=SE-3600*NH-60*NM
3940 NF$=CHR$(48+INT(NH/10))+CHR$(48+(NH-10*INT(NH/10)))+"."
3950 NF$=NF$+CHR$(48+INT(NM/10))+CHR$(48+(NM-10*INT(NM/10)))+"."
3960 NF$=NF$+CHR$(48+INT(NS/10))+CHR$(48+(NS-10*INT(NS/10)))
3970 RETURN
4000 REM CALCULATE 1ST COUNTER
4010 GOSUB1950B:IF CT=-1 THENEM=11:GOSUB1700:GOSUB1450:RETURN
4015 GOSUB2470:GOSUB3800:T1$=" ":GOSUB4300
4020 T$="START TIME (HH.MM.SS)":GOSUB2100:GOSUB2200
4030 IF ER<>BTHEN EM=2:GOSUB1700:T1$=N$:GOTO4020
4040 SE=N:GOSUB1750:GOSUB3900:TA$=NF$
4042 T=SE:IF SE>NL*60 THEN T=0
4B44 GOSUB433B:GOSUBI200:T1$=RIGHT$(A$,DG!:T$="START COUNTER READING"
4046 GOSUB2100:K=VAL(N$)
4048 IFK<B OR K>DN-1 THEN EM=1:GOSUB1700:T1$=N$:GOTO404b
4050 T=FNT(K):IF T<B OR T>60*NL THEN K=-1:GOTO4048
4052 TD=SE-T
4054 A=K:A1=DG:D1=0:GOSUB1100:CA$=RIGHT$("      "+A$,6!:GOSUB4330
4055 RETURN
4060 REM REPEAT ?
4065 EH=15
4070 KE$="R ":GOSUB1750:GOSUB1700:GOSUB1450
4075 RETURN
4100 REM TIME TO COUNTER
4110 N=7:GOSUB4000:IF CT=-1THENRETURN
4115 T1$=" ":GOSUB1750
412B T$="SECOND TIME (HH.MM.SS)":GOSUB2100:GOSUB2200
4125 IF ER<>0THEN EM=2:GOSUB1700:T1$=N$:GOTO4120
4130 SE=N:GOSUB3900:TB$=NF$
4135 T=SE-TD
4140 IFT<0 THEN T=T+24*3600
4145 IF T>NL*60 THEN EM=1:GOSUB1700:T1$=TB$:GOTO 4120
4150 GOSUB1200:CB$=A$:GOSUB4400:GOSUB4330:GOSUB1750
4155 GOSUB 4060
4165 KE$=" ":ON EX GOTO 4115,4170
4170 RETURN
4200 REM  COUNTER TO TIME
4210 N=8:GOSUB4000:IF CT=-1THENRETURN
4215 T1$=" ":GOSUB1750
4220 T$="SECOND COUNTER READING":GOSUB2100:K=VAL(N$)
4225 IFK<0 OR K>DN-1 THEN EM=1:GOSUB1700:T1$=N$:GOTO4220
4230 T=FNT(K):IF T<0 OR T>60*NL THEN K=-1:GOTO4225
4240 SE=T+TD:GOSUB3900:TB$=NF$
4245 A=K:A1=DG:D1=0:GOSUB1100:CB$=RIGHT$("      "+A$,6):GOSUB4400:GOSUB4330
4250 GOSUB4060
4260 KE$=" ":ON EX GOTO 4215,4265
4265 RETURN
4300 REM CLEAR TIME/COUNT DISPLAY
4310 TA$="          ":CA$=" ":TB$="          ":CB$=" ":TR$="          ":CR$=" "
432B RETURN
4330 REM PRINT TIME/COUNT
4340 RR=8:CC=B:GOSUB1800
4350 PRINT"          -TIME--        COUNTER"
4360 PRINT" (1)   ";TA$:"       ";CA$
4370 PRINT" (2)   ";TB$;"       ";CB$:PRINT
4380 PRINT" DIFF= ":TR$;"       ";CR$
4390 RETURN
4400 REM COMPUTE DIFFERENCE
4410 N$=TA$:GOSUB2200:T7=N
4412 N$=TB$:GOSUB2200:T8=ABS(N-T7)
4414 IF T8>12*3600THEN TB=ABS(T8-24*3600)
4416 SE=T8:GOSUB3900:TR$=NF$
4418 A=ABS(VAL(CA$)-VAL(CB$)):A1=DG:D1=0:GOSUB1100:CR$=RIGHT$("      "+A$,6)
4420 RETURN
4500 REM INSTRUCTIONS
4510 N=9:GOSUB195B
4520 PRINT"MOST TAPE RECORDERS, INCLUDING VIDEO AND";
4530 PRINT"CASSETTE DATA RECORDERS, HAVE A COUNTER"
4540 PRINT"WHICH IS LINKED TO ONE OF THE SPOOLS."
4550 PRINT"THE RATE AT WHICH THE SPOOL TURNS"
4560 PRINT"DEPENDS ON HOW MUCH TAPE IS WOUND ON IT"
457B PRINT"AND SO THE COUNTER IS NOT EASILY RELATED";
4580 PRINT"TO HOW MANY MINUTES' WORTH OF TAPE HAVE"
4590 PRINT"BEEN USED.":PRINT
4600 PRINT"THIS PROGRAM WILL WORK OUT THE RELATION-";
461B PRINT"SHIP AND CAN DISPLAY TIMES/COUNTER"
4620 PRINT"READINGS. IT WILL ALSO PRINT A TABLE"
4630 PRINT"THAT CAN BE USED TO FIND OUT HOW LONG "
464B PRINT"THE GAP IS BETWEEN TWO COUNTER READINGS."
465B GOSUB1450:GOSUB1950
4660 PRINT"THE PROGRAM REQUIRES THREE COUNTER"
4670 PRINT"READINGS AND THE TIMES AT WHICH THOSE"
4680 PRINT"READINGS OCCURRED.  IT IS ESSENTIAL THAT";
4690 PRINT"THE COUNTER IS AT ZERO WHEN THE TAPE IS"
4700 PRINT"FULLY RE-WOUND BUT IT IS NOT NECESSARY"
4710 PRINT"FOR THE FIRST TIME/READING TO BE AT THE"
4720 PRINT"START OF THE TAPE.":PRINT
4730 PRINT"TIMINGS ARE IN THE FORM HH.MM.SS WHERE"
4740 PRINT"   H = HOURS, M = MINUTES,S = SECONDS"
4750 PRINT"AND CAN BE 'TIME OF DAY' OR TIME-ELAPSED";
4760 PRINT"USING A STOP WATCH."
4770 PRINT"IT IS BEST TO USE READINGS SEPARATED BY"
4780 PRINT"AS BIG A GAP AS POSSIBLE TO IMPROVE THE"
4790 PRINT"ACCURACY.  E.G. HALF HOUR GAPS ON A 3HR"
4800 PRINT"TAPE - 2MIN GAPS ON A C15."
4810 GOSUB1450:GOSUB1950
4820 PRINT"FOR EXAMPLE, WITH A FOUR DIGIT COUNTER"
4830 PRINT"AND A 4 HOUR VIDEO TAPE THE FOLLOWING"
4840 PRINT"READINGS WERE TAKEN:-":PRINT
4850 PRINT"  TIME 19.31.23   COUNTER 1732"
4860 PRINT"       20.01.18         3194"
487B PRINT"       20.30.14         4445":PRINT
4B80 PRINT"THE TIMES WERE 'TIME OF DAY' AND WERE"
4890 PRINT"NOTED AS THE COUNTER JUST MOVED ON TO A"
4900 PRINT"READING.":PRINT"IF A STOP-WATCH HAD BEEN USED, THE FIRST";
4910 PRINT"TIME WOULD HAVE BEEN 00.00.00 AND THE"
4920 PRINT"SECOND 00.29.55 AND SO ON.":GOSUB1450:GOSUB1950
4930 PRINT"ENTERING THE COUNTER/TIME DETAILS WILL"
4940 PRINT"ADD TO A FILE OF TAPE TYPES THAT CAN BE"
4950 PRINT"EDITED AND SAVED TO DISK OR TAPE FOR"
4960 PRINT"LATER RECALL.":PRINT"ONE OF THE TAPE TYPES IS SELECTED AS THE";
4970 PRINT"'CURRENT TYPE' WHICH IS THE SUBJECT OF"
```

```
4980 PRINT"CALCULATIONS AND TABLE PRINTING."
4990 PRINT"THE TABLE IS USED TO LOOK UP A COUNTER"
5000 PRINT"READING, GIVEN A TIME FROM THE START OF"
5010 PRINT"THE TAPE.":PRINT"A TABLE HAS ROWS OF TEN COUNTER"
5020 PRINT"READINGS  I.E. ONE READING PER MINUTE"
5030 PRINT"- AND HENCE TEN MINUTES PER ROW."
5040 PRINT"A SIDEWAYS EXTENSION TO THE ROW GIVES"
5050 PRINT"THE COUNTS FOR 15,30 AND 45 SECONDS"
5060 PRINT"WITHIN THAT ROW.":GOSUB1450:GOSUB1950
5070 PRINT" A TYPICAL TABLE LOOKS LIKE THIS -":PRINT
5080 PRINT"MINS  ---0  ---1  ---3  ---4  ---5....":PRINT
5090 PRINT" 0X   0000  0070  0139  0207  0274...."
5100 PRINT" 1X   0660  0722  0843  0903  0962...."
5110 PRINT" 2X   1250  1306  1362  1417  ........"
5120 PRINT" 3X   1790  1841  1892..............":PRINT
5130 PRINT"SO THAT A READING OF 1892 IS 33 MINUTES"
5140 PRINT"INTO THE TAPE.  ALSO, IF ONE ITEM ENDS"
5150 PRINT"AT READING 1306 AND ANOTHER STARTS AT"
5160 PRINT"1892 THERE IS A GAP OF 11 MINUTES.":PRINT
5270 PRINT"THE PRINTER MUST BE SET TO PRINT AT"
5280 PRINT"LEAST 80 CHARACTERS TO A LINE.":GOSUB1450
5290 RETURN
5999 STOP
8000 REM OPEN FILE
8005 FL$="":DW=DV:IFDV<>DITHENB020
8010 FL$=RW$
8015 DPEN15,DI,15,"I0":SE=2
8020 ER=0:OPEN2,DV,SE,FI$+FL$
8030 IFDV=DI THENGDSUBB100
8040 IFER=0 THEN RETURN
8045 IF M<>63 THEN PRINT#15,"UJ":KE$=" ":GOSUB1450:GOSUB8200:RETURN
8050 EM=10:GDSUB1700:KE$=" RA":GOSUB1450:KE$=" ":GOSUB8200
8055 DN EX GOTD B090,0060,8065
8060 EM$(5)="REPLACE":FL$="SCR":GOTO 8070
8065 EM$(5)="APPEND":FL$=",S,A"
8070 EM$(5)="CONFIRM "+EM$(5)+" (Y/N)"
8072 EM=5:GOSUB1700:KE$="YN ":GOSUB1460
8075 KE$=" ":GOSUB1750:ON EX GOTO 8080,8090,8090
8080 IFFL$<>"SCR" THEN 8015
8085 OPEN15,DI,15,"S0:"+FI$:CLOSE15:GOTO8010
8090 ER=-1:RETURN
8100 REM DISK STATUS
8105 IF DV<>DI THEN RETURN
8110 ER=0:INPUT#15,M,M$,T,S
8120 IFM<20THEN RETURN
8130 RR=20:CC=9:GOSUB1800:PRINT"ERROR  ":M$
8140 ER=-1
8150 RETURN
8200 REM CLOSE FILE
8210 CLOSE2:IFDV=8THENCLOSE15
8220 RETURN
9000 DATA"0.  END"
9010 DATA"1.  LOAD TAPE TYPES"
9020 DATA"2.  SAVE TAPE TYPES"
9030 DATA"3.  ENTER NEW TYPE"
9040 DATA"4.  SELECT CURRENT TYPE"
9050 DATA"5.  DELETE TAPE TYPE"
9060 DATA"6.  PRINT TABLE"
9070 DATA"7.  CALCULATE COUNTER"
9080 DATA"8.  CALCULATE TIME"
9090 DATA"9.  INSTRUCTIONS"
9100 DATA"                                    ":REM 37 SPACES
9110 DATA"-- OUT OF RANGE --"
9120 DATA"-- FORMAT ERROR --"
9130 DATA"UNUSABLE INPUT - RE-TRY? (Y/N)"
9140 DATA"FILE SPACE EXHAUSTED"
9150 DATA"???"
9160 DATA"NO TAPES ON FILE"
9170 DATA"SELECT NUMBER OR"
9180 DATA"MAKE CURRENT TYPE? (Y/N)"
9190 DATA"NO DATA TO SAVE"
9200 DATA"APPEND (A), REPLACE (R) OR"
9210 DATA"NO CURRENT TYPE"
9220 DATA"POSITION PAPER IN PRINTER AND"
9230 DATA"PRINTING"
9240 DATA"LOAD ERROR"
9250 DATA"REPEAT (R) LINE 2 OR"
9260 DATA"LOADING"
9270 DATA"SAVING"
9600 DATA0,1,40,41,139,227,237,246,76,78,69,82,72,138,72,152,199
9610 DATA10,168,185,10,192,133,69,185,11,192,133,70,32,231,176,104,31
9620 DATA170,104,133,98,134,99,162,144,56,32,73,188,166,71,164,72,0
9630 DATA76,215,187,32,237,246,208,1,24,96,169,0,160,1,32,14,133
9640 DATA192,165,58,166,57,160,0,32,14,192,162,246,154,173,0,192,208
9650 DATA133,20,173,1,192,133,21,32,19,166,144,32,32,197,168,165,128
9660 DATA203,201,63,240,250,120,169,255,133,145,88,76,177,167,32,253,35
9670 DATA174,32,138,173,32,247,183,32,19,166,176,6,32,163,192,76,169
9680 DATA227,168,165,20,141,0,192,165,21,141,1,192,120,169,192,141,250
9690 DATA1,3,141,41,3,169,60,141,0,3,169,53,141,40,3,88,0
9700 DATA96,120,162,3,188,2,192,189,6,192,153,0,3,202,16,244,252
9710 DATA88,96,0,0,0,0,0,0,0,0,0,0,0,0,0,0,254
10000 REM ********** NOTES **********
10010 REM * ST = RESERVED VARIABLE STATUS
10020 REM * VALUE BECOMES 64 AT END OF FILE
10030 REM ****************************
10040 REM * MACHINE CODE IS OPTIONAL BUTSIMULATES 'ON ERROR GOTO'
10050 REM * THE STOP KEY CAUSES A BREAK WITH ERROR NO 128

READY.
```

Atari ST Super Breakout

by Robert Shelton

This program was written in Lattice C but should be reasonably easy to convert to other versions that run on the Atari ST. The game itself is mouse-driven and works with a black and white monitor only, although enterprising programmers should be able to get it to run on colour systems.

The source code listing should be typed in and saved onto the compiler disk which should also hold the files OSBIND.H and GEMLIB.H. The program can then be compiled as normal. After compilation the .BIN file should be transferred to the linker disk, which should also have files CLIB-.BIN, GEMLIB.BIN and GLIB.BIN. A link control file should be produced, consisting of the following:

```
INPUT STARTUP.BIN
INPUT *
LIBRARY CLIB.BIN
LIBRARY GEMLIB.BIN
LIBRARY GLIB.BIN
```

The program can then be linked using the control file.

To run the program with other C compilers, if the Line-A routines are implemented, then it should only be necessary to change int variables to long variables and short variables to int variables. If the Line-A routines aren't implemented, then it will be necessary to replace the bat and ball drawing routines with ones from the GEM libraries.

```
/*  Atari ST - Super Breakout
    For the SM124 Monitor
    By Robert Shelton
*/

#include    "osbind.h"                              /* Include COMPILER */
#include    "gemlib.h"                              /* Libraries off disc */

#define ADDR(a) ((long)a)>>16,((long)a)&0xffff      /* Macro for WIND_SET */

short workin[]={1,1,1,1,1,1,1,1,1,1,2},workout[57],  /* GEM Variables */
      handle,dummy;                                 /* For WORKSTATION */

int mainwindow,scorewindow;                         /* Window handles */

char *windows[]=                                    /* Window names */
   {   " Super Breakout "," High Scores "   };

char hiscorers[11][12]=                             /* Hi-score names */
   {   "ATARI ST",   "ATARI ST",   "ATARI ST",
       "ATARI ST",   "ATARI ST",   "ATARI ST",
       "ATARI ST",   "ATARI ST",   "ATARI ST",
       "ATARI ST"   };
```

```
int hiscores[11]=                                   /* Hi-scores */
   {   500,450,400,350,300,250,200,150,100,50   };

char characters[]="\x04ABCDEFGHIJKLMNOPQRSTUVWXYZ\x02";  /* Characters for
                                                            name entry */
char *strings[]=                                    /* Dialogue box */
   {   " Bat Sizes "," Small "," Large ",           /* Strings */
       " Lives "," 3 Lives "," 5 Lives ",
       " Start "," End "   };

OBJECT dialogue[]=                                  /* Dialogue box */
   {
   -1,1,4,G_BOX,NONE,NORMAL,0x21100,301,52,304,313,
   2,5,5,G_BOX,NONE,NORMAL,0xff1100,38,16,229,36,
   3,6,8,G_BOX,NONE,NORMAL,0xfe1100,38,68,229,48,
   4,9,11,G_BOX,NONE,NORMAL,0xfd1100,38,132,229,48,
   0,12,13,G_BOX,NONE,NORMAL,0xfc1100,38,196,229,48,
   1,-1,-1,G_STRING,NONE,NORMAL,0,50,10,128,16,
   7,-1,-1,G_STRING,NONE,NORMAL,0,70,8,92,16,
   8,-1,-1,G_BUTTON,SELECTABLE|RBUTTON,SELECTED,0,16,24,64,18,
   2,-1,-1,G_BUTTON,SELECTABLE|RBUTTON,NORMAL,0,151,24,64,18,
   10,-1,-1,G_STRING,NONE,NORMAL,0,86,8,56,16,
   11,-1,-1,G_BUTTON,SELECTABLE|RBUTTON,SELECTED,0,16,24,72,18,
   3,-1,-1,G_BUTTON,SELECTABLE|RBUTTON,NORMAL,0,141,24,72,18,
   13,-1,-1,G_BUTTON,SELECTABLE|EXIT|DEFAULT,NORMAL,0,16,16,56,18,
   4,-1,-1,G_BUTTON,SELECTABLE|EXIT|LASTOB,NORMAL,0,157,16,56,18
   };

short box[4],button,mousex,mousey;

short ball[]={8,8,0,1,0,                            /* Graphic definition */
              0,0x0000,0,0x07e0,0,0x1ff8,0,0x3ffc,  /* of the ball shape  */
              0,0x3fcc,0,0x7fce,0,0x7fee,0,0x7fde,
              0,0x7ffe,0,0x7ffe,0,0x7ffe,0,0x3ffc,
              0,0x3ffc,0,0x1ff8,0,0x07e0,0,0x0000},
      ballsave[40];                                 /* Buffer for screen */

int numlifes,                                       /* Number of lifes */
    ballspeed,ballxp,ballyp,                        /* Ball variables */
    ballxv,ballyv,ballover,balls,

    speed,score,numbricks,redraw,pass,              /* Game variables */

    oldxp1,oldyp,oldxp2,oldpw,                      /* Bat variables */
    newxp1,newyp,newxp2,newpw,maxpw,

    finished=0,                                     /* Return to desktop */

    erase,brickx1,bricky1,brickx2,bricky2;          /* Game variables */

char endgame[]="Game Over",
     sound[]={   0,0,1,0,7,62,8,16,11,128,12,4,13,0,255,0   },
     bricks[18][7];

/* ------------------------------------------------------------------------ */

main()                                              /* Program starts here */
   {
   startopsys();                                    /* Start GEM */
   prepare_form();                                  /* Prepare dialogue box */
   createwindows();                                 /* Create windows */

   while(!finished)                                 /* Loop until done */
      {
      drawscreen();                                 /* Draw screen */
      getgametype();                                /* Get game parameters */
      if(!finished)
         {
         playgame();                                /* If START playgame */
         }
      }

   destroywindows();                                /* Erase windows */
   endopsys();                                      /* Shut down GEM */
}

/* ------------------------------------------------------------------------ */

startopsys()                                        /* Routine to start GEM */
{
   appl_init();
   handle=graf_handle(&dummy,&dummy,&dummy,&dummy);
   v_opnvwk(workin,&handle,workout);
   vswr_mode(handle,1);
   a_init();                                        /* Start Line-A Routines */
}

/* ------------------------------------------------------------------------ */

endopsys()                                          /* Routine to end GEM */
{
   v_clsvwk(handle);
   appl_exit();
}

/* ------------------------------------------------------------------------ */

createwindows()                                     /* Create windows */
{
   mainwindow=wind_create(NAME,16,18,608,366);      /* Create MAIN window */
   wind_set(mainwindow,WF_NAME,ADDR(windows[0]),0,0);
   scorewindow=wind_create(NAME,32,64,256,256);
   wind_set(scorewindow,WF_NAME,ADDR(windows[1]),0,0); /* Create SCORE window */
}

/* ------------------------------------------------------------------------ */

destroywindows()                                    /* Destroy windows */
{
   wind_delete(mainwindow);
   wind_delete(scorewindow);
}

/* ------------------------------------------------------------------------ */

drawscreen()                                        /* Draw title screen */
{
   v_hide_c(handle);                                /* Hide mouse */
   setfill(2,4,1);                                  /* Clear screen */
   drawbox(0,0,639,399);
   wind_open(mainwindow,16,18,608,366);             /* Open MAIN window */
   clearmain();
   wind_open(scorewindow,32,64,256,256);            /* Open SCORE window */
   clearscore();
   drawscore();                                     /* Print Hi-Scores */
   wind_set(mainwindow,WF_TOP,0,0,0,0);
   graf_mouse(0,0);
   v_show_c(handle,0);                              /* Show mouse */
}

/* ------------------------------------------------------------------------ */

getgametype()                                       /* Operate dialogue box */
{
   int count,exit;
   for(count=0;count<32767;count++);                /* Delay */

   form_dial(0,301,52,304,313,301,52,304,313);      /* Prepare dialogue box */
   form_dial(1,16,16,16,16,301,52,304,313);

   objc_draw(dialogue,0,3,0,0,640,400);             /* Do dialogue box */
   exit=form_do(dialogue,-1);

   form_dial(2,16,16,16,16,301,52,304,313);         /* Erase dialogue box */
   form_dial(3,301,52,304,313,301,52,304,313);

   if(exit==13) finished=1;                         /* No more? */
   dialogue[12].ob_state=NORMAL;

   if(dialogue[10].ob_state&SELECTED) numlifes=3;   /* Number of lives */
   if(dialogue[11].ob_state&SELECTED) numlifes=5;
   if(dialogue[7].ob_state&SELECTED) maxpw=32;      /* Bat size */
   if(dialogue[8].ob_state&SELECTED) maxpw=48;

   setfill(2,8,0);
   drawbox(301,52,301+304,52+313);
}

/* ------------------------------------------------------------------------ */

playgame()                                          /* Main game loop */
{
   int delay,count;                                 /* General counters */
   char string[2];                                  /* String buffer */

   drawfield();                                     /* Draw screen */

   oldxp1=304; oldxp2=336; oldpw=32; oldyp=380;     /* Position bat */
```

```
    score=0; redraw=1; erase=0;                          /* Set game variables */

    printf("\x1bY 3Super Breakout - \x1bj00000000 - Super Breakout");

    for(balls=1;balls<=numlifes;balls++)                 /* Loop until no more */
       {                                                 /* balls left */
       ballxp=320; ballyp=200; ballxv=1; ballyv=1;       /* Position ball */
       newpw=maxpw; pass=0;

       setfill(2,8,0);                                   /* Draw countdown box */
       drawbox(304,184,336,216);

       for(count=0;count<5;count++)                      /* Countdown */
          {
          sprintf(string,"%1d",5-count);
          v_gtext(handle,316,208,string);
          dosound(1,255);
          for(delay=0;delay<32767;delay++);
          }

       setfill(2,8,1);                                   /* Erase countdown box */
       drawbox(304,184,336,216);

       a_sprite(ballxp,ballyp,ball,ballsave);            /* Draw ball */
       ballover=0; speed=1;

       while(!ballover)                                  /* Until ball lost */
          {
          moveball();                                    /* Move the ball */
          movebat();                                     /* Move the bat */
          xbios(37);                                     /* Wait for screen */

          a_color(1);                                    /* Remove bat and ball */
          a_unspri(ballsave);
          a_line(oldxp1,oldyp,oldxp2,oldyp);

          if(erase)                                      /* Erase brick? */
             {
             drawbox(brickx1,bricky1,brickx2,bricky2);    /* YES */
             erase=0;
             }

          a_color(0);                                    /* Draw bat and ball */
          a_line(newxp1,newyp,newxp2,newyp);
          a_sprite(ballxp,ballyp,ball,ballsave);

          oldxp1=newxp1; oldxp2=newxp2; oldyp=newyp;     /* Update bat */
          oldpw=newpw;
          }
       a_unspri(ballsave);                               /* Remove ball */

       }

    setfill(2,8,0);                                      /* Draw endgame box */
    drawbox(276,184,366,216);
    v_gtext(handle,286,208,endgame);

    for(count=0;count<9;count++)                         /* Wait */
       {
       for(delay=0;delay<32767;delay++);
       }

    sortscores();                                        /* Sort scores */
    v_show_c(handle);
}

/* ------------------------------------------------------------------------ */

moveball()                                               /* Move the ball */
{

    int brickx,bricky;

    ballxp=ballxp+(ballxv);                              /* Move ball */
    ballyp=ballyp+(ballyv*speed);

    if(ballxp<24 || ballxp>616)                          /* Hit sides? */
       {
          ballxv=(-ballxv);                              /* Alter direction */
          dosound(4,128);
       }

    if(ballyp<40)                                        /* Hit top? */

          ballyv=(-ballyv);                              /* Alter direction */
          if(newpw==maxpw) newpw=maxpw/2;                /* Shrink bat */
          dosound(10,128);
          ballyp=40;
          pass=0;                                        /* Ball can hit bricks! */
       }

    if(ballyp>400) ballover=1;                           /* Ball lost? */

    if(ballyp<newyp && (ballyp+8)>newyp)                 /* Hit bat? */
       {
       if(ballxp>=newxp1 && ballxp<=newxp2)
          {
          dosound(8,128);
          ballyv=(-ballyv);                              /* Calculate return */
          if(ballxp<(newxp1+newpw/2)) ballxv=(-1);       /* Speed of ball */
          if(ballxp<(newxp1+newpw/4)) ballxv=(-2);
          if(ballxp<(newxp1+newpw/3)) ballxv=(-3);
          if(ballxp>(newxp1+newpw/2)) ballxv=1;
          if(ballxp>(newxp1+3*newpw/4)) ballxv=2;
          if(ballxp>(newxp1+7*newpw/8)) ballxv=3;
          if(redraw) drawbricks();                       /* Redraw bricks? */
          pass=0;
          }
       }

    brickx=(ballxp-32)/32; bricky=(ballyp-88)/16;        /* See if hit brick */

    if(!pass && bricky<6 && bricky>(-1) && bricks[brickx][bricky]
                                        && brickx<18 && brickx>(-1))
       {
       addscore(6-bricky);

       if(speed==1 && bricky<4) speed=2;                 /* Speed brick? */
       if(bricky<2 && speed!=4) speed=3;
       if(bricky<1) speed=4;

       erase=1;                                          /* Notify routine to */
       brickx1=32+32*brickx; brickx2=brickx1+32;         /* erase brick */
       bricky1=88+16*bricky; bricky2=bricky1+16;

       numbricks--;                                      /* One brick less */
       if(numbricks==0) redraw=1;                        /* Redraw? */
       bricks[brickx][bricky]=0;

       ballyv=(-ballyv);
       pass=1;

       dosound(1+bricky,255);
       }
}

/* ------------------------------------------------------------------------ */

movebat()                                                /* Routine to move bat */
{
    vq_mouse(handle,&button,&mousex,&mousey);            /* Locate mouse */
    newyp=mousey;
    if(newyp<290) newyp=290;                             /* Scale Y position */
    if(newyp>390) newyp=390;
    newxp1=mousex;
    if(newxp1<24) newxp1=24;                             /* Scale X position */
    if(newxp1>(640-24-newpw)) newxp1=(640-24-newpw);
    newxp2=newxp1+newpw;
}

/* ------------------------------------------------------------------------ */

drawfield()                                              /* Routine to draw walls */
{
    wind_close(scorewindow);                             /* Shut windows */
    wind_close(mainwindow);
    v_hide_c(handle);
    setfill(2,8,1);                                      /* Clear screen */
    drawbox(0,0,639,399);
    setfill(2,9,1);
    drawbox(0,16,640,32);                                /* Draw perimeter */
    drawbox(0,32,16,400);
    drawbox(624,32,640,400);
}

/* ------------------------------------------------------------------------ */
```

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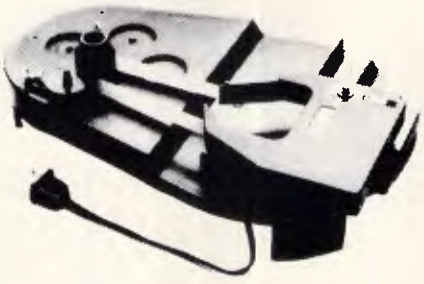

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```
addscore(x)                                     /* Update score */
int x;
{
   score=score+x;                               /* Add points */
   printf("\x1bk\x1bj%8ld",score);              /* Print score */
}

/* ------------------------------------------------------------------------ */

dosound(tone,length)                            /* Beep! */
int tone,length;
{
   sound[3]=tone;                               /* Set tone & length */
   sound[9]=length;
   xbios(32,sound);                             /* Perform sound */
}

/* ------------------------------------------------------------------------ */

drawbricks()                                    /* Routine to draw bricks */
{
   int x,y;

   for(y=0;y<6;y++)                             /* Loop to draw bricks */
      {
      setfill(2,y+1,1);                         /* Set fill pattern */
      for(x=0;x<18;x++)
         {
         drawbox(32+x*32,88+y*16,64+x*32,104+y*16);   /* Draw brick */
         bricks[x][y]=1;                        /* Brick in position */
         }
      }
   redraw=0; numbricks=108;
   setfill(2,8,1);
}

/* ------------------------------------------------------------------------ */

sortscores()                                    /* Routine to sort scores */
{
   int count,position;

   for(position=0;position<10;position++)       /* Sort scores into order */
      {
      if(score>hiscores[position])
         {
         for(count=10;count>position;count--)
            {
            hiscores[count]=hiscores[count-1];
            movmem(hiscorers[count-1],hiscorers[count],11);
            }
         getname(position);                     /* If hi-score get name */
         hiscores[position]=score;
         position=10;
         }
      }
}

/* ------------------------------------------------------------------------ */

getname(name)                                   /* Routine to get name */
int name;
{
   int letter,number,more=0;
   char buffer[2];

   setfill(2,8,0);                              /* Clear name box */
   drawbox(32,168,608,232);
   setfill(2,8,1);
   drawbox(34,170,606,230);
   vst_effects(handle,0);
   setfill(2,8,0);
   for(number=0;number<28;number++)             /* Draw alphabet */
      {
      drawbox(41+number*20,184,58+number*20,216);
      buffer[0]=characters[number];
      buffer[1]=0;
      v_gtext(handle,46+number*20,208,buffer);
      }

   for(letter=0;letter<11;letter++)
      {
      hiscorer[name][letter]=0;
      }

   drawbox(272,240,368,272);                    /* Draw name box */
   vst_effects(handle,0);
   v_show_c(handle,0);
   letter=0;

   while(!more)                                 /* Enter name */
      {                                         /* Wait for no button */
      while(button!=0)
         {
         vq_mouse(handle,&button,&mousex,&mousey);
         }
      while(mousex<41 || mousex>598 || mousey<184 || mousey>216 || button!=1)
         {
         vq_mouse(handle,&button,&mousex,&mousey);
         }

      number=(mousex-41)/20;

      if(letter<10 && number!=0 && number!=27)  /* Add letter to name */
         {
         buffer[0]=characters[number];
         buffer[1]=0;
         v_gtext(handle,281+letter*8,264,buffer);
         hiscorers[name][letter]=characters[number];
         letter++;
         }

      if(letter>0 && number==0)                 /* Delete letter */
         {
         buffer[0]=32; buffer[1]=0;
         v_gtext(handle,272+letter*8,264,buffer);
         hiscorers[name][letter]=32;
         letter--;
         }

      if(number==27)                            /* End name */
         {
         more=1;
         }

      while(button!=0)                          /* Wait for no button */
         {
         vq_mouse(handle,&button,&mousex,&mousey);
         }
      }
   v_hide_c(handle);
}

/* ------------------------------------------------------------------------ */

setfill(x,y,z)                                  /* Routine to set fills */
int x,y,z;
{
   vsf_interior(handle,x);
   vsf_style(handle,y);
   vsf_color(handle,z);
}

/* ------------------------------------------------------------------------ */

drawbox(x1,y1,x2,y2)                            /* Routine to draw box */
int x1,y1,x2,y2;
{
   box[0]=x1; box[1]=y1;
   box[2]=x2; box[3]=y2;
   v_bar(handle,box);
}

/* ------------------------------------------------------------------------ */

clearmain()                                     /* Routine to clear */
{                                               /* main window */
   setfill(2,8,0);
   drawbox(17,36,622,382);
}

/* ------------------------------------------------------------------------ */

clearscore()                                    /* Routine to clear */
{                                               /* hi-score window */
   setfill(2,8,0);
   drawbox(34,83,285,317);
}
```

```
/* ------------------------------------------------------------------------ */

drawscore()                                     /* Routine to print */
{                                               /* high scores */
   int count;
   char buffer[256];

   for(count=0;count<10;count++)
      {
      sprintf(buffer,"%-16s %8ld",hiscorers[count],hiscores[count]);

      if(count==0) vst_effects(handle,1);
         else      vst_effects(handle,0);

      v_gtext(handle,59,120+count*16,buffer);
      }

   sprintf(buffer,"%-16s %8ld","Previous score",score);
   v_gtext(handle,59,296,buffer);
}

/* ------------------------------------------------------------------------ */

prepare_form()                                  /* Routine to prepare */
{                                               /* dialogue box for use */
   dialogue[5].ob_spec=(long)windows[0];
   dialogue[6].ob_spec=(long)strings[0];
   dialogue[7].ob_spec=(long)strings[1];
   dialogue[8].ob_spec=(long)strings[2];
   dialogue[9].ob_spec=(long)strings[3];
   dialogue[10].ob_spec=(long)strings[4];
   dialogue[11].ob_spec=(long)strings[5];
   dialogue[12].ob_spec=(long)strings[6];
   dialogue[13].ob_spec=(long)strings[7];
```

Bludner

In the July issue, a segment of code was inadvertently omitted from the program BBC Fonts in 'Program File'. This code allows the program to work with the Acorn Electron. The necessary modifications are given in Fig 1.

```
   10 REM ************************************************************
   20 REM *** The following additions and changes are for the Electron ***
   30 REM ************************************************************
   40
   50 REM Ensure line numbers match with main program!
   60
  410 LDA £227:LDX £144:JSR &FFF4
  760 \ line not needed for Electron
  770 \ line not needed for Electron
 2000 IF JX<>52188 + 3*(ONDIV256 + ONMOD256) PRINT''"Checksum error":END
 2400 IF FNyes("Print key codes") PROCkeycode
 2800 DEF FNK(J) =FNblock("FUNC")+"+"+FNblock(CHR$(65+J))
 2810 :
 4000 DEFPROCkeycode
 4010 ON ERROR GOTO2460
 4020 VDU148
 4030 *FX3 10
 4040 FOR I=0 TO 10
 4050 asc=65+2*I:ch=128+2*I
 4060 PRINT'font$(I)TAB(15)"ON = Func + "CHR$asc" or VDU ";ch
 4070 IF I<10 PRINTTAB(14)"OFF = Func + "CHR$(asc+1)" or VDU ";ch+1" or VDU 148"
 4080 NEXT I
 4090 *FX3
 4100 ENDPROC
```

Fig 1

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And of course with software written for the 65C816, the speed increase would be even more impressive. And there is plenty of animation of software, even for the 6502 running at 1MHz.

Graphics flexibility is good too. Not only can the GS handle all of the old screen standards supported by the II+, IIe and IIc, it can also give four colours with 640 × 200 resolution, and 16 colours with 320 × 200 resolution. Those 16 colours are selectable from a pallette of 4096 possible colours, and you can change the pallette for different horizontal slices of the screen, so that the bottom half uses a different 16 colours from the top half, for example.

But sound is where the machine comes into its own. The GS (as sold in Australia) is supplied with an 'Ensoniq' chip fitted. This is a dedicated sound processor with no less than 32 oscillators, giving 15 independent sound channels. That may seem like more than you would ever reasonably use — after all, who needs a 15-note chord? — but when you hear what the chip can do you will be impressed. How about the voice synthesis that is almost indistinguishable from the real thing? Or the sound of chimes (very difficult to synthesise), also just like the real thing?

I'm sure that the sound capabilities of the GS will be used to the full by software developers, especially in the educational market.

System software

The GS is supplied with a software package called Mouse Desk, which is basically the same sort of user interface that the Mac supports. When you move the mouse across your desk, a pointer moves across the screen. You can 'pick and place' files or groups of files by pressing the mouse button, and so on.

'The poor old processor in the GS is doing not only all of the calculation, but all of the screen driving as well.'

Major differences between the Mac operating system and the GS which are immediately visible are that the GS' screen is a colour one, and that the Mac is perhaps marginally faster. But anyone familiar with the Lisa or Mac will have no problem in picking up the conventions used in Mouse Desk.

Although I was supplied with a prerelease copy of Mouse Desk, I didn't have the documentation to go with it, so I couldn't get more than a vague idea of its capabilities.

Mouse Desk seems to have all of the features of, say, GEM or Microsoft Windows, and has accessories like a calculator and a puzzle. Although there was no clock accessory, the GS does have a clock/calendar built in and I assume that the release version of the software will have a clock as an accessory.

Mouse Desk allows you to copy, delete and move files from one 'folder' to another, or from one disk to another. It lets you look at text files on the screen, and will show you a directory either as icons, or as text arranged by name, date, size or type.

It also handles disk formatting, and setting up new folders. A feature called 'selector' seems to allow the addition of the path and file name of an application to a list that comes up in the main menu bar at the top of the screen — but without the documentation I couldn't be 100 per cent sure of what its function was.

Disks appear on the screen as little disk icons — the RAM disk, when it is configured, also appears as a disk icon. A 'trash can' icon at the bottom right of the screen is for deleting files, folders and disks.

The reset sequence (pressing apple-control-reset) reboots from a system disk in any drive. A very nice feature is that you can reboot without corrupting the RAM disk. Everything that was in there when you started the boot will still be there when the system comes up again.

System parameters like RAM disk size and screen format are controlled by a ROM-resident program called 'Control Panel'. This comes up when you press apple-control-esc, and presents a menu of system features that can be set permanently.

I say "permanently" because all of the settings in the control panel are stored in battery backed-up CMOS RAM, so that they will still be in force when you next turn the machine on. This is a better arrangement by far than having an autoexec file — especially if you are running the system from floppy disks.

The 'display' option lets you choose mono or colour output, 40 or 80 columns, and the screen text and border colours. 'Sound' lets you set the volume and pitch of the beep. 'System speed' will switch the execution speed of the processor to either 1MHz (for running old applications) or 2.8 MHz.

'Clock' lets you set the internal timer/calendar, and also allows you to choose what date and time format you want. Anyone who has been confused by the American month/day/year format while using American written business software will appreciate this.

The Control Panel will let you choose from either US, UK, French, Danish, Spanish, Italian, German or Swedish display characters, and will let you set up the keyboard to operate with all of the above, plus French Canadian and Dvorak keyboard layouts. It will also set the speed of the key repeat, mouse response, and so on.

You can set the functions of the slots, and select which is to be the start-up slot (you can even start-up from the RAM disk, although I can't think why you would want to).

The Control Panel lets you set the printer and modem ports (the two serial ports built into the GS) to no less than 15 different baud rates and alter protocols. It also allows you to select what size the RAM disk is to be.

Applications

Of the three pre-release applications which I was given with the machine, one of them wouldn't work. That's understandable with pre-release applications, but unfortunately it was the one I would most liked to have played with, having seen a demo of it: a full colour paintbox application. Such is life.

The two that did work were impressive enough, though. The first was a mouse-driven spreadsheet and graphics program called VIP Professional. The other was a tape deck.

I don't know exactly how, but the Ensoniq chip can be used to reproduce recorded sound. Some sort of sampling method is used, which can then drive the chip to produce about a minute of stereo sound from an 800k file. The sound

Benchmarks

I had hoped to get the benchmarks running at both the slow and fast systems speeds (1MHz and 2.8MHz), but the fast speed doesn't seem to work with Apple Basic. I suspect that this may be a bug that Apple will fix in later releases, and if this is the case, then the benchmarks should be 2.8 times faster.

BM1	0.5
BM2	2
BM3	6
BM4	6.5
BM5	7.5
BM6	9
BM7	17
BM8	19
Average	8.4

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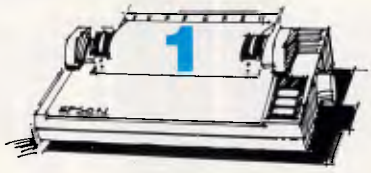

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quality is so good, you would be forgiven for thinking that it came from a record or tape. With that sort of capability, the GS and the Ensoniq chip are a mighty combination for games and education.

Bose, the speaker company, has released a version of its 'Roommate' speaker/amp combination to match the GS.

Documentation

As always with Apple, the documentation is faultless. Although I didn't get a full set, the volumes that I saw were excellent. So much for the documentation — I wish it was this good for all machines.

Prices

Apple says that the GS will be available by late October. Price is my only disappointment with the machine. With a IIc system costing $1195 in Australia, and a IIe $2345, the GS looks very expensive at $3495. And that's for the mono version plus one disk drive — a GS with one drive and a colour monitor will set you back $3995.

The machine must be cheap to produce in quantity, since it uses so few components. Sure, Apple has to recoup development cost, but once it's done that it must surely reduce the price?

Conclusion

The GS is an exciting machine for all sorts of reasons. Firstly and most importantly, it's capable of running thousands of applications written for the Apple II over the years — many of them for education. The GS will run most of them (Apple claim 90 per cent), and those of the rest that are still selling will probably be modified.

Also, it's capable of supporting Apple II plug-in boards, of which there must be several hundred. Specialist applications from astronomy to pottery have had Apple compatible boards designed for them.

Apple has added AppleTalk to the Apple II line, allowing a lot of the Mac hardware to be addressed as well.

The only area Apple hasn't addressed is IBM compatibility. Even in education this would have been a good move — there are a lot of packages which teachers and researchers would like to use, that are written to run under MS-DOS. With a processor as powerful as the 65C816, most other companies would have been more than tempted to try for at least MS-DOS emulation, and an IBM compatible disk drive as an option. But, for the reasons I outlined right at the start of this review, not Apple.

The sound and colour capabilities of the GS, plus all of the readymade software and hardware to hang off it, make it a very attractive machine for teaching and research. If only the price were lower, the GS would consolidate Apple's hold on education markets.

Apple seems a little unsure of just where the machine fits — again, releasing a good product and then letting the market decide what to do with it, in the Apple tradition. It's not seen by Apple as a replacement for the IIe or IIc, and Apple has said that it does not expect to sell it in bulk on a one-per-desk basis. So what will it be used for?

Apple's answer is that a teacher may have a GS, while the students have less powerful machines. But what's the point in giving the teacher access to sound and hi-res graphics if the students don't have it too? Time, and the market, will tell.

I have no doubt that the GS is an excellent machine in a lot of ways, and perhaps if the price comes down it will start to make a major impact.

Apple also has its eye on the 3 million Apple IIs worldwide (80,000 in Australia). It is going to offer upgrades for Apple IIs starting early next year, at a price which has yet to be decided.

As this issue went to press, Apple announced that the upgrade would comprise a 'GS' motherboard and back panel and would cost $1295 — Ed.

END

Technical specifications

Processor:	65C816 running at 1MHz switch selectable to 2.8MHz
RAM:	256k expandable to 8Mbytes
ROM:	128k expandable to 1Mbyte
Keyboard:	Detachable 80-key, including 10-key numeric keypad
I/O:	One dedicated multi-purpose RAM/ROM memory expansion slot; 7 additional input/output slots
DOS:	Supports ProDos 16, ProDos 8, Pascal, CP/M (with Z-80 card) and Apple DOS 3.3.
Mass Storage:	A choice of either 3.5in 800k disk drive; 5.25 140k disk drive; 20Mbytes hard disk.

CHIP CHAT

Waterhead's revenge . . . well really. It was tempting fate to extract the waste product from International Resource Development last month. The waterhead sanctuary has responded with an in-depth analysis of what effect the video phone will have on the world.

Can it be that people will have false clothes handy for when the phone rings in the bath? Will it stop us making faces at the receiver when someone makes a complete gonzo statement?

No. According to IRD, the main result of videophones will be to kill the video dating market.

Why pay money, IRD argues, to see your prospective dates at some agency's video parlour when you can see everyone you speak to on the phone? Well yes, but surely that means ringing up prospective partners at random, having a quick shufti, and then asking them out. Who knows, you might even manage a bit of heavy breathing. How about this for the ultimate computing obscenity? I quote from the *San Francisco Chronicle:* 'A 15-year-old computer buff, left alone to tinker in his bedroom, was found stabbed to death after his parents grew worried after not seeing him for two days.' Two days! Turns out he

owed his best friend $85 for a printer, and the friend got ratty when the money wasn't forthcoming . . . We do get some odd information sent to us. The Hungarian Chamber of Commerce has sent details of a medicinal bathing salt, supposed to be good for gynaecological ailments. Just thought our 2.7 per cent of female readers would like to know that . . . What will IBM do now that it's losing market share and lots of PC profit to the clone makers? Perhaps it will decide on a proprietary architecture, offer compatibility with PC-DOS for a while, then, when software companies see the value of exploiting the machine's proprietary features, quietly close the door and leave the so-called compatibles to fight to the death . . . Watch out for intelligent agents. You tell these programs what you want and they go off and do it. You know the kind of thing — 'Get me all the information we've got on Mrs Blenkinsop, knock up a decent report and send a copy to each of the directors' . . . What's in a name? Quite a lot, on the evidence of recent press releases received at our red brick fortress . . . First in was US corporation Connecticut Software which wishes to inform us that the name DOS Commander (as applied to its DOS shell software) belongs exclusively to the aforesaid corporation. What's more, it would like us to 'alert them immediately' to any use of the word 'Commander' in descriptions of software by other vendors. Anxious to comply, we dashed off telexes to Peter Norton (author of The Norton Commander shell). Peter replied with alacrity, and is of the opinion that the word 'Commander' is no more subject to ownership than is, say, 'Cola' (as in Pepsi versus Coca) or 'Word' (as in Microsoft versus The Final versus Samna). In a private aside he likened Connecticut's claim to an organic substance (of equine origin) used to promote the growth of roses. END

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